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Commissions in Officers' Reserve Corps

THE INTEREST of engineers in the movement for military preparedness is reflected in Army orders published last week listing appointments to commissions in the Officers' Reserve Corps. Among the names are those of a number of well-known engineers. Bion J. Arnold, consulting engineer, of Chicago, and John J. Carty, past president of the American Institute of Electrical Engineers, have been named majors. Others appointed to this rank are John H. Finney of Washington, E. W. Stern of New York and F. A. Molitor, secretary of the American Institute of Consulting Engineers. From the Middle West, Frank G. Jonah of St. Louis, a director of the American Society of Civil Engineers, and Prof. Gardner S. Williams of Michigan University, have been appointed majors. The list of captains, first lieutenants and second lieutenants is a long one, and includes men identified with important engineering work of all kinds throughout the country. It is to be noted that, on a geographical basis, the East shows overwhelming preponderance of appointments as compared with territory covered by the central and western departments of the Army. However, the work is still in its early stages. A great many more reserve officers will be needed, and it behooves those who are willing to volunteer their services to apply now to be examined. It is understood that the War Department's requirements, while high, are not so strict as to exclude a man not letter perfect in military detail.

A Unique Construction Problem

THE inclined tunnels driven to insure the stability of the Michigan Northern Power Company's plant at Sault Ste. Marie, described on page 292 of this issue, represent a most ingenious solution to a problem unique in hydroelectric construction. Since this power plant was designed and built the tendency in hydroelectric design has been away from a large number of small units to generate power under low heads. The problem of the company which took over this development was to procure the maximum efficiency from the plant, which was more than 1500 ft. long and contained 81 tail pits for independent generator units. The thrust developed under the heads at which operation was most economical produced a slight displacement of the structure itself and made it inadvisable to maintain the forebay at the operating level contemplated in the original design. To jack inclined pipe piles down to rock beneath—the piles to take up this thrust—was impracticable because of the large number of vertical piles already driven to support the plant. Some of the best engineering talent of the country has been engaged on the solution of this problem, and as a final result the extraordinary method of driving inclined tunnels with compressed air has been resorted to. The construction work itself has been successful in every particular, and there is no reason to doubt that when completed it will fulfill its mission. The ingenuity with which the construction difficulties were overcome furnishes an interesting insight into the resourcefulness of the modern construction engineer. The work proves again, if proof were needed, that where there is adequate reason for putting forth the effort the American contractor can be counted on to stop at nothing short of the accomplishment of the results desired.

For Better Operation

PROBABLY no other structure which the municipal engineer builds needs more attention—and gets less—than the sewage-disposal plant. Several years ago Prof. C. E. A. Winslow made a trip in the winter to the Middle West to learn how various plants were being operated. To his astonishment he did not find a single one working. Apparently progress is not fast, for a record not much better was reported for eight plants in Illinois visited in January by a representative of the newly established engineering department of the State Board of Health, as noted on page 307. It is true the towns are not large and practically none has organized sewer departments, but at some time in the past there has been sufficient interest or pressure to furnish funds for construction. Undoubtedly in each case an engineer has been employed to design the treatment works. While he may have felt that he did his full duty at the time of the completion of the work in giving instructions as to operation, maintenance and appropriations for them, he has not done enough, if we are to judge by results. The argument that he is not now responsible will not answer. He, or at least the profession, must carry a share of the blame if the plant does not produce the results for which it was designed. His education of the layman officials and citizens of that particular city was not sufficient to insure proper operation after he left. The desire to keep down expense, however laudable, must be controlled by the exigencies of individual cases. One practical way out of the difficulty would seem to be to retain continually the original designer, or some other qualified engineer, on a small retainer to keep an experienced eye on the operation. Many eastern cities are doing this, but the plan needs indorsement farther west.

Time to Stop "Passing the Buck" on Motor-Truck Legislation

IN ESTABLISHING the new schedule of taxes on motor trucks in New York State, which took effect Feb. 1, the special commission, consisting of the state highway commissioner, the state engineer and the state superintendent of public works, so obviously sidestepped its specific instructions to base the new charges on extent of damage to the roads that its findings did little or nothing to solve a complex problem. It is good news therefore to learn that a bill has been introduced at Albany calling for a new commission to revise the latest commission's revisions. The schedule in its present form is nothing more than a makeshift—and a poor one at that. It was prepared in a hurry, and while the commission was solicitous for the presentation of technical data at its public hearings—and received a great deal of valuable information—it has, in its wisdom, apparently pigeonholed the testimony submitted to it. At any rate, it is hard to discover its influence in the commission's final report. Certainly the schedule of fees, starting with a minimum of $10 for a 2-ton truck and increasing by $5 increments per gross ton, is unscientific.

This question of motor-truck legislation in New York State has been a perennial one. In naming its special commission last year, the Legislature, in the light of later developments, is regarded, by the motor truck men at least, as having given an illuminating exhibition of "passing the buck." The latest schedule of fees strengthens the belief that the special motor-truck commission has passed the buck back again. Now as in indoor sport this may all be highly diverting, but the motor truck has reached a position in industrial life which demands for it respectful and intelligent consideration. It is time for New York and other states to get down to the serious business of placing the matter of motor-truck taxes upon a sound, scientific and just basis—and justice must consider the interests of the motor truck as well as those of the highway. Statistics for 1916 show an increase in the use of commercial vehicles in New York State of 66 per cent over the figures for 1915. There were at the beginning of the year 34,653 motor trucks in the state, as against only about 21,000 in the previous year.

The present graduated flat-rate basis of taxation on gross weight alone is entirely illogical, and the new bill to have this schedule revised should be passed. The proposed measure provides for a commission one of whose members shall be an automobile engineer. This is a commendable feature. The tendency in the past has been to make commissions of this sort onesided by having their membership drawn entirely from interests affiliated with the building and maintenance of highways. But there is more than one side to the story, and the motor-truck men as well as the road builders should be heard. Present efforts are being directed to secure a basis of taxation which will grade charges according to loading per inch width of tire, instead of the present gross-weight ruling. The unit-weight plan is already operative in Massachusetts, where the value is fixed at 800 lb. per inch width of tire, and is also contemplated in a new bill before the Michigan legislature.

Former attempts at motor-truck legislation make it seem that those who enact laws fail to appreciate the diversity in motor-truck design. For this reason it is desirable to have an automobile engineer on any commission which attempts to prepare schedules for taxation purposes. In the present New York law the truck running on narrow tires and at high speeds is penalized no more than the vehicle designed to distribute the weight over a considerable area of the road surface by broad tires. Then, too, there are such subjects as springs, overall widths, limitation on gross weight, steel versus rubber tires, and many other factors which should receive consideration. With its public hearings and requests for expert opinion, and then its schedule of fees entirely disregarding scientific principles, the special motor-truck commission achieved a result comparable with that of the mountain which labored and brought forth a mouse.

The new commission, provided for in the pending bill, has an opportunity of performing work of incalculable value if it will conduct its investigation along engineering lines. If its work is well done, it will serve not only New York State but other states throughout the country, which are now, or will soon be, facing the problem of imposing an equitable tax on motor vehicles which use the public highways.

The National Safety Council

ESTABLISHED with the broad purpose of helping to free mankind from accidents, the National Safety Council, numbering among its membership 2500 of the largest industrial, transportation and other corporations in this country, is publishing monthly leaflets on safe practices. Representing, as they do, the findings of a committee of 50 safety experts in the service of this, the leading accident-prevention agency of the country, these leaflets should have a far-reaching effect on the conservation of human life and efficiency. Three of these leaflets—on ladders, stairs and stairways and on boiler rooms—have already been issued. Their purpose is to distribute the information in concrete and popular form throughout the country. No standardizing will be attempted, it being considered that the greatest good can be accomplished by stating the problems met in attempting to reduce accident hazards, together with the best solutions found. The minimum and maximum safety practices are stated, and the requirements of insurance companies, state and local authorities are given when practicable.

While the scope of this work is so broad as to include every phase of accident prevention, it has a direct application to the engineer and contractor. The man who designs and builds structures for the use of others should be familiar with every means which can be taken to make them safer for those who are to use them. Those who construct public and private works are directly interested in this movement as pointing the way to greater safety and efficiency in their own working force.

Safety work costs less than accidents and increases operating efficiency. The tremendous economic savings which this work can bring about if it is as universally supported as it deserves to be are foreshadowed by the results already accomplished. Of 21 industrial corporations already identified with this movement, reductions in accidents as a result of proper safety work range from 22 to 88 per cent, with a majority of these percentages nearer the higher than the lower figure. Of 15 transportation properties, ranging in size from the Boston Elevated Railway Company to the Union Pacific System, reductions in accidents range from 19 to 80 per cent. The attention of the master minds engaged in increasing the ratio of production to population is undoubtedly turning from material to human factors. Of these, accident prevention is of the most important. The work of the National Safety Council deserves the best of attention and support from the engineering profession.

A New Era in Teaching English to Engineers

SELDOM has the Engineering Record published articles on general subjects that should have as wide a reading as those of Professor Park and Professor Aydelotte on the teaching of English to engineering students. Instruction in English is one of the perennial questions in engineering education. Quite generally the methods now employed are condemned by practising engineers, while, on the other hand, students have even less regard for the courses.

The typical course in English is given in the arts school, by an arts teacher, without any distinction in method of instruction between the arts and the engineering student. The work is intrusted to young members of the faculty, on the theory that it is an abbreviated, incidental course. Engineers do very little work in English, so the theory seems to go; why then dig deeply for them? Is it any wonder that engineering students generally regard the engineering courses as a necessary evil—a means of getting certain credit hours required for graduation?

In the courses at the University of Cincinnati and Massachusetts Institute of Technology, however, the very great importance of English to the engineer is appreciated, and the work is in the hands of those who sympathize with engineers and engineering and are determined to adapt their teaching to the needs of the student. The courses developed are set forth on pages 297 to 302 of this issue.

It will be noted that there is one thing in common in the two plans—the use of theme material that has a bearing on the student's future lifework, and this is the first of the excellent features of the two systems. The idea, too, is fundamental and the resulting superstructure—the methods of instruction followed—would bring but poor success were general material substituted for engineering material.

But though there is a common idea underlying the courses, their mechanism is decidedly different—and that makes the development all the more interesting and insures a more rapid growth in the teaching of English to engineers than if these two pioneers were working along the same lines. Professor Park aims rather to develop rapidly a good technique in English composition; Professor Aydelotte to make the English courses a means of broadening the engineer's outlook. Both writers reveal in a few flashing sentences the philosophies of their plan.

For example, Professor Park points out that by telling the student to describe a particular engineering process, device or project for a given engineering journal the student's "relation to his subject and audience will be the normal one of the writer who has something interesting to say and who has a definite motive for saying it effectively." And again he says: "There is nothing better for developing mental alertness and skill in writing than the rapid preparation of a variety of articles. It is more than a coincidence that a large proportion of literary men have served some kind of journalistic apprenticeship."

On the other hand, with equal clarity, Professor Aydelotte sets forth the philosophy of the course at the Massachusetts Institute of Technology. Says he: "The widespread demand that our college men, graduates of technical schools and colleges of liberal arts alike should be better able to write and speak their mother tongue is really a demand that they have a better literary education. A man's writing reflects his habit of thought, and it is simply impossible to give him a cultivated style by any other method than by making him a cultivated man."

It will be noted that Professor Aydelotte says nothing about the correction of the themes presented and the conferences regarding defects in logic and rhetoric. Let it be understood, though, that this part of the work is carried out in great detail. In the space available Professor Aydelotte has found it possible to emphasize only the big idea on which the course at Technology is founded.

Naturally the publication of the two articles in one issue prompts comparison. That was not the Engineering Record's object in presenting them together. The thought was rather that, by pointing out at one time the great strides in the teaching of English to engineering students, the engineering profession would better appreciate that a new era in the engineer's education is dawning. Preference will be expressed for the one or the other plan largely in accordance with the experience and the aspiration of the individual. Both plans, however, are excellent, and both are producing most satisfactory results.

Inclined Tunnels Buttress Power Plant

Forty Shafts, Driven to Rock with Shields and Compressed Air at Angle of 50 Degrees, Permit Increasing of Head on Michigan Development

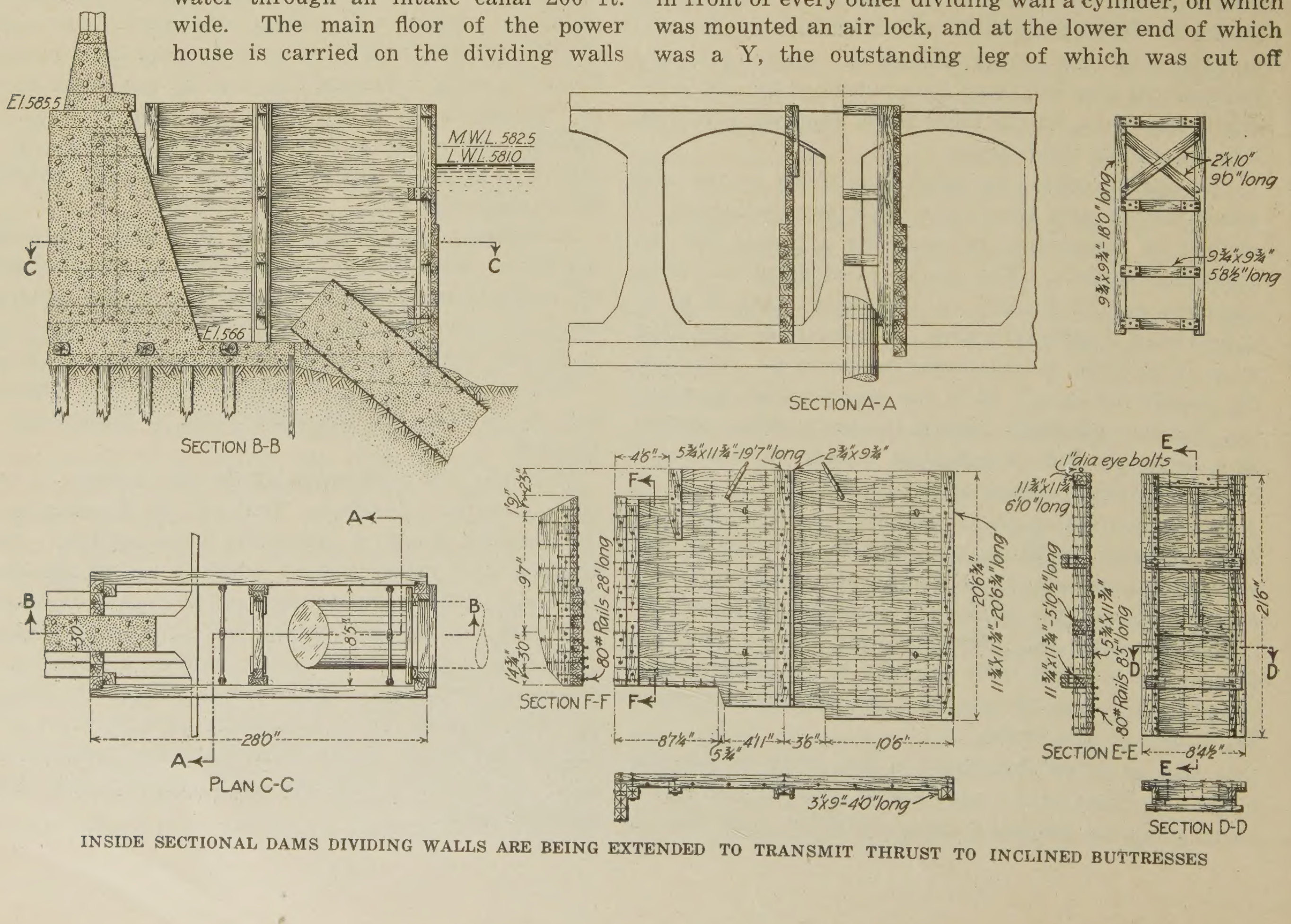
FORTY INCLINED tunnels, driven to rock by the shield method, lined with cast-iron segments and filled with concrete, now buttress the large generating station of the Michigan Northern Power Company at Sault Ste. Marie, Mich. This power house, 1300 ft. long, and containing 81 tail pits, is founded on a concrete mat carried by 40-ft. piles driven to rock. It showed movement toward the river under a 12-ft. head, and has not been operated at heads of more than 15 ft., though designed for a maximum static head of 22 ft.

The extraordinary construction undertaken to insure the stability of the power house under full head involved a combination of caisson, tunnel and cofferdam methods unique in the history of American contracting. The unusual problems encountered, such as how to start the shields between adjoining tailraces discharging at 3 ft. per second, how to get muck out of headings driven at 40 deg. with the horizontal, and how to connect the finished shafts with the existing piers between tail pits, were met with ingenious solutions. The pneumatic work was carried out between the end of June last and the beginning of the present year without interruption to the continuous operation of the power plant.

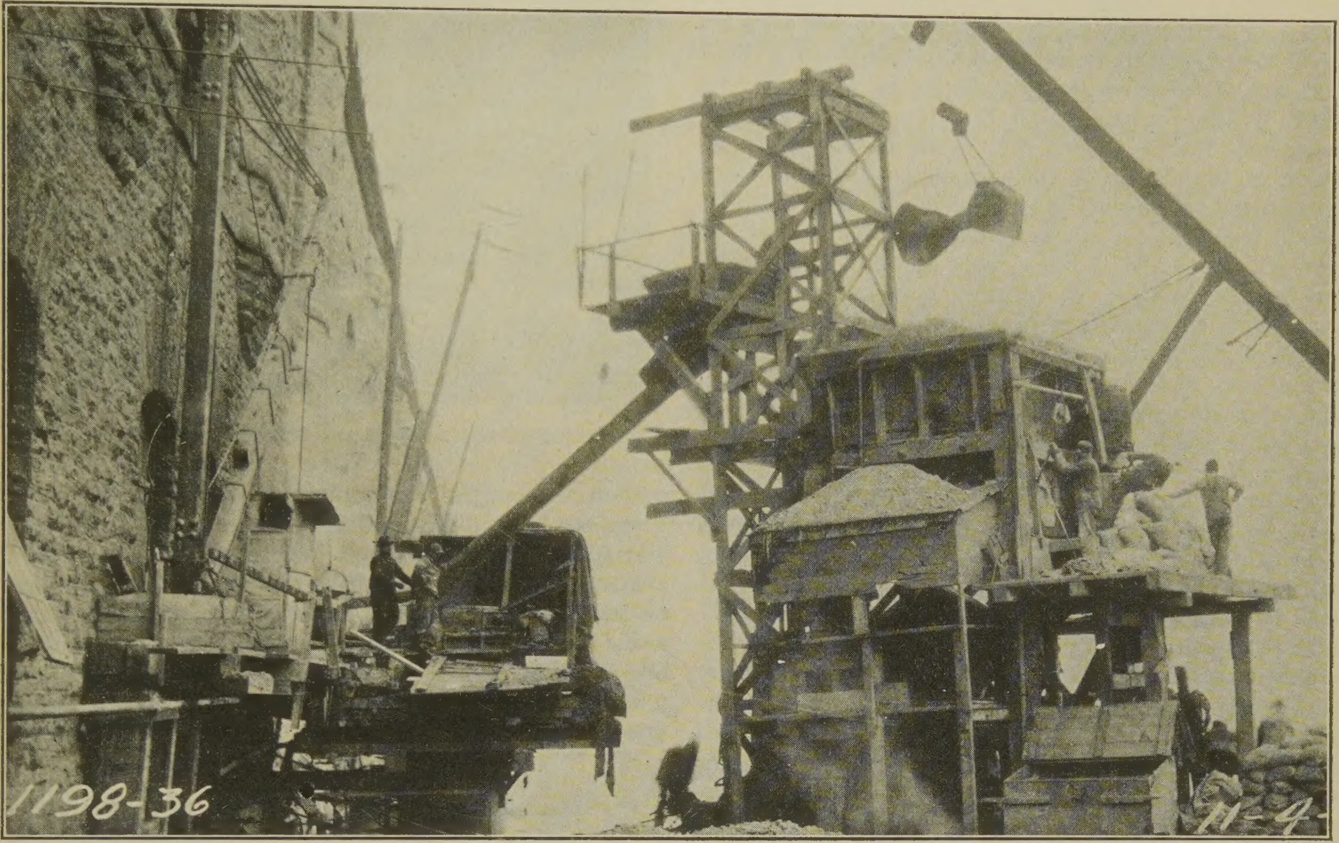
POWER DEVELOPMENT IN USE UNDER REDUCED HEAD

The power plant in question is located in Sault Ste. Marie, Mich., on the south bank of the St. Marys River, about 12 miles below Lake Superior. It is supplied with water through an intake canal 200 ft. wide. The main floor of the power house is carried on the dividing walls between the discharge tunnels, which in turn rest on a concrete mat 3 ft. 7 in. thick, supported by 40-ft. piles driven through glacial deposit to bedrock, which is sandstone, and approximately level under the site of the plant. The plant was constructed for operation with a normal difference of 16 ft. and a maximum difference of 22 ft. in elevation between the water in the forebay and tailrace level in the river. However, it was discovered when water was admitted to the forebay that the power house showed a slight movement toward the river under heads exceeding 12 ft., so that it was considered prudent to limit the head to 15 ft. The power house and discharge-tunnel structure appeared to move as a unit, the motion probably taking place by the pushing over of the top of the piles through the saturated sand in which they were driven. The motion varied from almost nothing near the ends to 2 in. or more near the center. Various methods were discussed for strengthening the substructure of the power house so that the maximum head could be utilized, and it was finally decided to construct inclined concrete buttresses extending from the dividing walls to rock under the river and having sufficient strength in compression to take the load represented by the horizontal thrust on the south face of the power house produced by the maximum head. Work on the execution of this plan was begun by the Foundation Company in June of last year.

The plan followed was to set on the concrete apron in front of every other dividing wall a cylinder, on which was mounted an air lock, and at the lower end of which was a Y, the outstanding leg of which was cut off



INSIDE SECTIONAL DAMS DIVIDING WALLS ARE BEING EXTENDED TO TRANSMIT THRUST TO INCLINED BUTTRESSES on a horizontal plane at the level of the river bed, and formed a hood within which to erect a small tunnel shield. Such a shield, with two rings of segmental cast-iron lining, was assembled in this hood and driven outward and downward on an angle of 40 deg. with the horizontal to rock. After reaching solid rock a chamber was belled out beyond the shield, and the chamber, shield and tunnel filled with concrete. The air-lock and cylinder were then removed for use in another location, and a sectional cofferdam of timber placed around the upper end of the finished shaft and the space between it and the end of the dividing wall. Within this space was built an extension to this wall, keyed into its old face, and covering the end of the new shaft. Upon these extended piers, which project 18 ft. beyond the wall of the power house, will be built a reinforced-concrete bridge to form an additional railway crossing over the company's power canal. During this construction about 42 of the tail pits, or all that were equipped for operation, have been in continuous use.



TUNNELS WERE CONCRETED IN SIX TO EIGHT HOURS EACH BY FLOATING PLANT WHICH WILL ALSO BUILD BRIDGE

CONSTRUCTION LAYOUT ACCOMMODATED TO EXISTING CONDITIONS

The construction work required means for the receipt, storage and handling of tunnel rings and of cement and concrete materials. A very large compressor plant, with provisions for high-pressure air and hydraulic pressure for operating jacks was necessary, and means had to be found for handling and setting the heavy air locks and cylinders, for hoisting and disposing of excavated material and for mixing and placing concrete.

The cast-iron lining plates were delivered by water, transported on flat cars on a standard-gage track inside the power house next the downstream wall, piled at the desired points and dragged on plank through the windows and lowered into the cylinders by the derricks used for sinking. These derricks, of which ten were framed on the job, were supported on engine-bed timbers stuck through windows in the wall on a skew. The end of these timbers supporting the mast was blocked from a narrow ledge outside over one of the dividing walls. The hoists were likewise supported on timbers outside the building, and were supplied by steam lines carried within the power house. In some locations the derrick bed timbers were placed entirely outside the power house parallel to the wall and bracketed out from the wall and the piers. Twenty-five-foot masts handling 25 and 38-ft. booms were used for these derricks. The top of the mast was secured by a single long gooseneck extending through a small window above, a row of which opened on that side of the power house about 25 ft. above the floor. This gooseneck was bolted to a timber spanning the window opening, which in turn was bolted to and braced from the roof framing above. In addition, the gooseneck was blocked from the window opening on all sides. These derricks were inspected daily, and with the first signs of play, cable lashings were added sufficient to make them secure.

FLOATING PLANT HANDLES LOCKS AND CYLINDERS

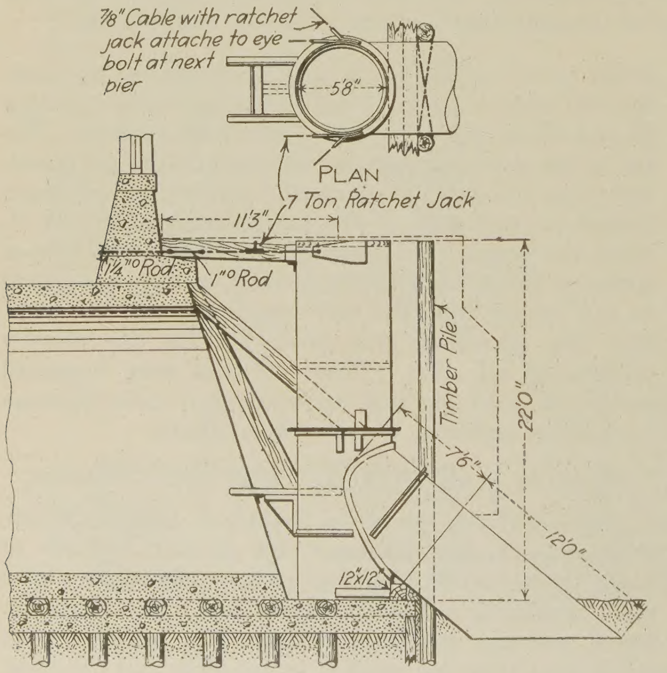
These derricks, however, could not handle the air locks and cylinders, although each of them was able to reach three tunnels from one setup. The heavy pieces were handled by a floating derrick boat built at the site, which was also used as a dredge. The derrick on the mixer boat was also utilized to set locks and cylinders and to assist in dredging. It was equipped with a 1-yd. clamshell bucket, while the other dredge employed a

1-yd. orange peel. The mixer on the floating concrete plant was fed by gravity from overhead bins filled by the derrick, and discharged into a tower skip, which could be raised high enough to spout directly into the air locks. This same plant will also be used to concrete the bridge spans by direct spouting, the tops of the air locks having stood considerably above the deck of the bridge. A tug handled this equipment and towed four scows, the largest of which was used for gravel, the three smaller ones being employed to transport mud used to blanket the tunnels.

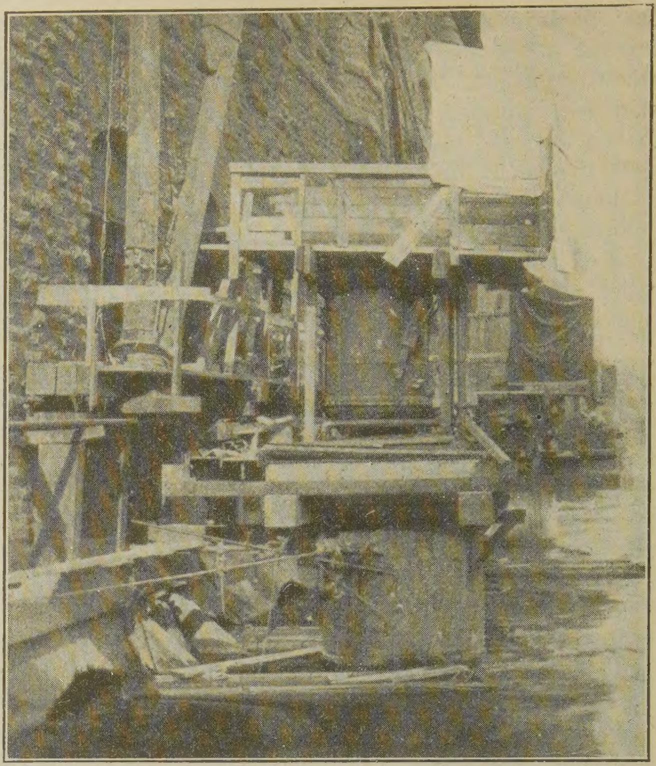
CONCRETE MATERIALS HANDLED AT DOCK

All plant and materials were received at a dock just east of the power house. This dock was used as a yard by the contractor, all framing and assembling being done there. During the navigation season, on account of the fact that the company which furnished mixed sand and gravel did not have sufficient scows to permit their use for storage, and of necessity after the close of navigation, a large stock pile of this material was kept on the dock. For heating this material a number of long steam coils were made up on the dock floor, on top of which the sand and gravel was piled by a derrick erected at the spot for unloading purposes. Until the navigation season closed cement was also received by boat as well as coal. A large cement shed was erected capable of holding a shipload. Between the concreting of the tunnels, the mixer boat would be taken down the dock, where it would load its own bins and receive a stock of cement. It held enough material to fill one tunnel, and when more was required the large scow was used to transport it.

High-pressure air for running the drills inside the tunnels was furnished part of the time by a small electrically driven compressor and part of the time by the power company from its regular supply. Compressed air for driving the tunnels was furnished by four straight-line, single-stage compressors installed by the contractor. Two high-pressure pumps driven by steam and one driven by electricity were installed for operating the hydraulic jacks. For running this equipment two of the boilers in the regular pumping plant of the power company were cut in with three small locomotive boilers installed by the contractor inside the power house and four large locomotive boilers set outside it. All these boilers were connected into one steam main. They also furnished the steam for heating the sand and gravel. The coal consumption of this equipment was large, from 35 to 40 tons a day being used.



DIFFICULTY OF ANCHORING CYLINDERS CLEVERLY MET



OPERATIONS CARRIED ON IN SCANT WORKING SPACE

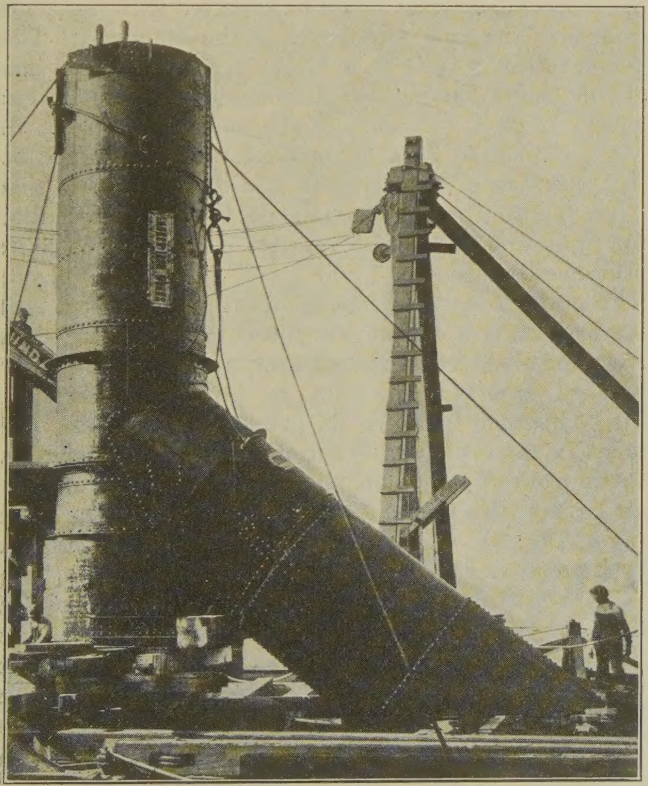
CYLINDERS BRACED IN STRONG CURRENT

Equipment was provided for driving ten tunnels simultaneously, and the contractor actually had air on nine of them at one time. In starting work on each tunnel, the first thing done was to inspect the spot on which the cylinder was to be set by diving, and to level it off where necessary. A cylinder, in which the shield had been assembled, was then brought up and set in approximate position by the derrick boat. It was usually possible then to shut down an hour or two first one and then the other of the turbines discharging on either side of the site. On the side where the water was still, the horizontal and inclined timber struts shown in the drawing were set, and the rod and wire ties were secured to anchorages previously drilled in the dividing wall back of the cylinder. When the opposite turbine was shut down, the same thing was done on the other side. The cylinder was set with a timber underneath the Y, outside each end of which against the hood round piles were driven to hold it in place. It was then possible by setting up an instrument outside the wall of the power house on the center line of the tunnel to pull the cylinder into exact position and turn it by means of turnbuckles on the guy rods so that the hood stood exactly at right angles to the face of the power house. The cylinders were weighted down by piling material on timber weight platforms supported on brackets riveted to them for the purpose. At first plenty of tunnel rings were available for weight, but later I-beams and old columns owned by the power company were employed. When the cylinder had been correctly set, the derrick boat placed an air lock on top of it and banked the hood with clay brought in on the small scows or with material dredged near by. When this was done, air pressure was turned on and a gang of three men entered the cylinder to start the shield.

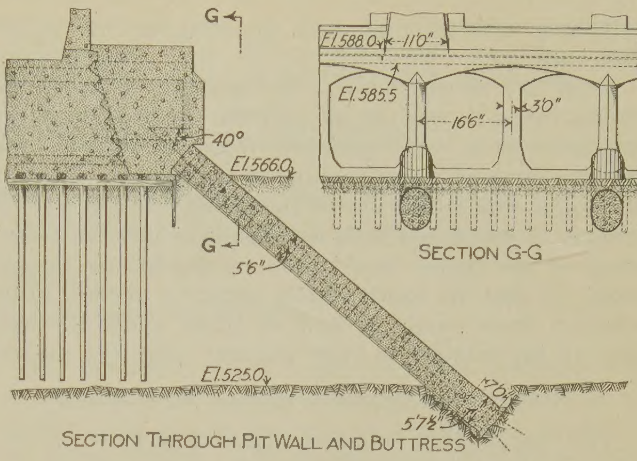
HOISTING BUCKETS OUT OF INCLINED TUNNEL

The shield, which had an inside diameter of 5 ft. 7½ in., was shoved ahead by 2 or 3 jacks, the lining rings, of five cast-iron segments each, being erected in the tail in the ordinary way. The shield was shoved one ring at a time, and plates for one ring were always kept lying on the lock platform so that there would be no delay when a ring was signalled for. In spite of the difficulty of working at an inclined face, on several occasions three shoves were made and three rings set within 12 hours. The tunnel rings were made up so that a joint in each ring came at the bottom, giving a continuous line of flanges on which the bucket could slide to the bottom of the tunnel. The derrick line was never taken off the bucket, passing around a roller set in the cylinder at the top of the hood when the bucket was in the tunnel.

The bucket was lowered vertically, guides of timber being placed from the bottom door of the lock to the base of the cylinder, until it struck inclined timber guides on a line with the floor of the tunnel. These started it on its descent, and also guided it against the vertical timbers when it was pulled out. There was no danger of the bucket fouling the roller, as the latter was at a sufficient height above the upper end of the tunnel floor to allow the bucket to swing clear before the bail was within a foot of the roller. The buckets were packed level full with sand and gravel, and what little spilled out on the ascent merely served to fill up the lower part of the rings and make a better track for the bucket to slide on. All the material taken out was dumped over the hood of the cylinder. Frequently, because of rapid erosion by the turbine discharge, this was not enough to keep the upper end of the tunnel covered, and more clay had to be brought in by barge. When a derrick was working a cylinder to one side, the buckets were quickly dumped over the hood by swinging them a short distance out. When a derrick was working a cylinder directly in front of it, however, it was not possible to boom down far enough to dump over the end of the hood, and a short wood chute with a hopper at the upper end would be rigged to carry the dirt to the proper point.



SHIELD ASSEMBLED IN Y OF CYLINDER BEFORE SETTING



SECTION THROUGH PIT WALL AND BUTTRESS

SECTION G-G

INCLINED TUNNELS TRANSMIT THRUST TO ROCK

GROUT AND OAKUM PLACED IN LINING JOINTS

As perfectly tight tunnels were desired by the owners, cement was kept at the heading and a can of grout mixed every time a ring was set. Oakum was laid against the ring last placed, outside the bolt holes, and daubed with grout as the next plate was set. This method produced joints which were free from leakage, practically the only air lost escaping at the top of the shield. Indeed, leakage at this point became serious in the first tunnels driven, and there appeared to be a danger of blows. To prevent this, and to keep material from the top from running into the heading, small hoods 18 in. wide at the top and tapering to nothing at the bottom were made of ¼-in. plate and bolted to the cutting edge of each shield before driving was started.

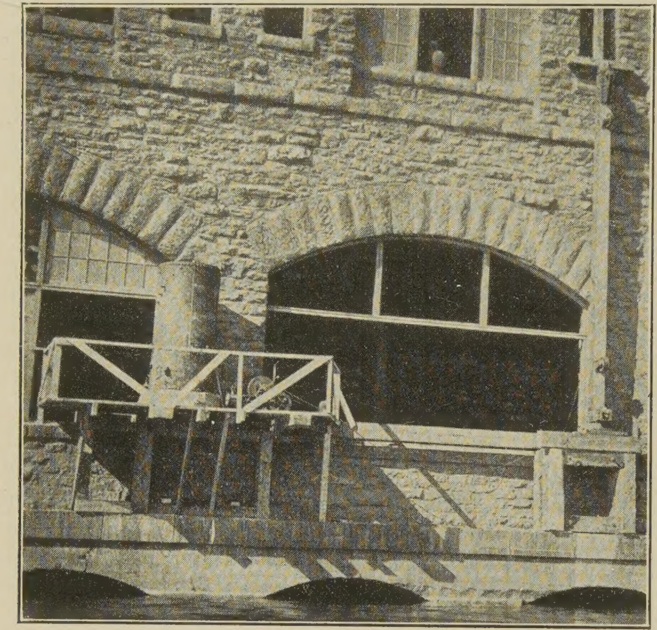
BELLS REQUIRE CAREFUL SHOOTING

When each shield had been driven a number of feet into solid rock, a bell was excavated, enlarging from the diameter of the shield to a diameter of 7 ft. 9 in. about 18 in. beyond the cutting edge. For cylinders 20 and 21, deeper bells were excavated because of greater thrusts on them, one reaching a maximum diameter of 9 ft. and the other one of 10 ft. In excavating these bells, only the cut was drilled and loaded as in ordinary tunnel practice. No relievers were used, but about 25 trim holes were drilled after the cut had been shot, six sticks of dynamite being divided into small charges and every other hole loaded. This light shooting avoided cracking the rock outside the excavation limits and the danger of blowing out at the top, but required a large amount of trimming with chipping tools to bring the bell to full size.

After the excavation was finished, the inside of the tunnel would be washed out perfectly clean with a hose and about 80-lb. water pressure. Washing started at the top, the dirt and water running to the bottom. Most of the water would blow out of the shield, leaving a small amount of water and sand to be bailed out. The alignment of the tunnel would then be checked by instrument, so that its exact bottom could be plotted, after which a chute would be built of plank under the lock door in the cylinder to start concrete down the tunnel.

TUNNELS CONCRETED WITHIN 6 TO 8 HOURS

The tunnels were bottomed under 25 to 29 lb. of air, which made it possible to lock concrete in with considerable speed even at the first. As the concrete rose, the air pressure could be reduced until only a short time was required for a man to take through a batch. Frequently, 15 1-yd. batches an hour were placed, and it required only 6 to 8 hours completely to fill a tunnel. Two men stayed at the bottom of the tunnel and came up with the concrete, while the third went in and out with the batches in order to wipe off the gasket on the bottom lock door each time, to prevent delays. The concrete was allowed to run down the bottom of the tunnel from the wood chute under the lock door, there being no particular object with mass work of this nature in avoiding the filling of the corners of the lining rings at the bottom with concrete which set a little in advance of the main body. The concrete, of course, came up with a horizontal surface. When this reached the point where it would overflow into the hood, a bulkhead was built at the bottom of the first lining ring and concrete was shoveled over the top of it from the chute until all but the last lining ring was packed completely full.



DERRICKS WERE BRACKETED OUT FROM POWER-HOUSE WALL

After the concrete had set, the hood was unbolted from the cylinder, leaving the latter clear of the upper end of the tunnel. The lock and cylinder were then removed, after which the hood was dragged from around the tunnel by a wire rope bridle placed at the time the cylinder was set and tied during driving to some convenient anchorage on the dividing wall. By this arrangement the only driving equipment lost with each tunnel was the shield itself.

SECTIONAL COFFERDAMS SET BY DIVER

The next step was for one of the derrick boats, with the assistance of a diver, to level off the dirt around the upper end of the tunnel. One of the sectional wood cofferdams was then set and dirt banked around its outer end, using short sheeting where this came above the bottom. The inner ends of the side sections projected into the draft tubes, but the outer ends had to be weighted down with I-beams. Concrete to a thickness of 2 ft. was then placed under water by bottom-dump buckets beyond the edge of the mat underneath the power house around the upper end of the tunnel. It was found on pumping out some of these cofferdams that the new seal had not bonded with the old concrete, producing serious leaks. In these cases an additional seal of concrete 6 in. thick was placed over the entire floor of the cofferdam. The sides of the cofferdam were clamped around the center bracing and to the end sections by rods and turnbuckles, which were placed and adjusted by the diver. After the seal had set, the dam would be unwatered with a small pump and the pier constructed in the ordinary way. The turnbuckle rods could be taken out as soon as the coffer was dry, the water pressure being sufficient to hold the sections tight against the oakum with which the joints had been calked by the diver before pumping was begun.

RAPID PROGRESS MADE IN TUNNEL DRIVING

Considering the fact that numerous boulders had to be blasted in driving the tunnels, progress on them was not much slower than would be expected with horizontal tunnels of the same size driven in the same way. They averaged thirty-six 1-ft. 9½-in. rings apiece, one tunnel of this length having been driven and belled out in rock within 12 days. Because of the unusual nature of the work, it took 40 days to complete the first tunnel, but the others were all driven in less than half this time. After the first tunnel was finished, bonuses were offered for rapid progress, which resulted in a considerable improvement in speed.

In order to secure properly distributed support from the first tunnels driven, the power company picked out 10 cylinders to be completed first, and after these were finished specified 12 more to be done. Following the completion of these 22 cylinders the others were taken in any order at the option of the contractor. The entire work of tunnel driving took less than six months, air having been taken off the last cylinder on the morning of Dec. 30. Since that date, the cofferdam work has been prosecuted.

The construction details were designed and the work has been carried on by the Foundation Company, John W. Doty, vice-president, with W. I. Johnson as superintendent, for the Michigan Northern Power Company under the supervision of L. H. Davis, general manager and chief engineer, and of S. H. Woodard, consulting engineer.

How Technical Journalism Is Taught in a Co-operative Engineering School

Student's Loathing for the "Theme" Removed by Having Him Read Technical Journals Critically and Limiting His Work to That Which He Knows

By C. W. PARK
Associate Professor of English, University of Cincinnati

EVERY engineering student is potentially a contributor to one or more technical journals. Even if he does not chance upon suitable material for publication during his college period, he will not be long in practice before his observation or experience will give him ideas which he will wish to share with other members of his profession. It is partly on this assumption of future authorship that all students in the College of Engineering at the University of Cincinnati are given a course which consists of writing for publication, or *as if* for publication.

TECHNICAL ARTICLES ANALYZED

This sort of "journalistic preparedness" has more immediate advantages, however, which are sufficient in themselves to justify it as a part of the engineering student's training in English composition. By analyzing various articles in order to study their technique the student learns to classify them readily and to grasp their content easily. He learns where to look for general discussion and where for specific information, and he thus becomes able to collect and sift bibliography intelligently. By noting the emphasis on timeliness, originality, and practical usefulness in magazine articles he gains a better appreciation of their technical value, as well as a clearer notion of what would be an acceptable contribution from him.

From the standpoint of the teacher of composition, no better exercises could be found than a set of journalistic assignments. If the best models are followed, the student will have unexcelled opportunity to develop observation, a sense of proportion, variety of phrasing and ability to write simple, clear, smooth, and straightforward English. Best of all, his relation to his subject and audience will be the normal one of the writer who has something interesting to say and who has a definite motive for saying it effectively.

A BAN ON EMPTY GENERALITIES

The importance of this last advantage will be made clearer by a brief consideration of the conventional and perfunctory thing called a "composition," the sort of dissertation which certain authors' relief associations advertise to furnish on any subject at a moderate rate per page. The regulation composition is pretty certain to be of the discussion type—that is, it is a disquisition on some general topic, such as "Concrete Buildings," "Asphalt," "Submarines," "Colonial Architecture," "Scientific Management," "Industrial Preparedness," "Electric Furnaces," "River-Improvement Work," and so on. Now there are persons whose experience fits them to write interesting and valuable discussions on these subjects, but such persons are not likely to be found among college undergraduates.

The magazine editor, a part of whose business is to protect his public against uninteresting and unprofitable reading, has no use for general discussions submitted by young writers. The student who attempts to write on one of these topics must either deal in empty generalities or present a warmed-over rehash of some one else's discussion. In other words, he must simply assemble the ready-made parts into the most respectable unit he is able to make. This process of putting standard parts of a composition together, which is often called "preparing a paper," is not without value, especially if skill is used in selecting and fitting the pieces. There are even rare cases in which the material is completely rewrought into what is virtually an original product, and I am far from denying, of course, that certain kinds of second-hand writing, such as reviews and abstracts, call for considerable skill.

VAGUE ASSIGNMENTS DANGEROUS

The point I would make here is that the general discussion type of composition as it is nearly always written by college students is not a vital, nor in the best sense an original, exercise. It may be necessary to use it extensively where teachers and students are unable to find live material, but certainly it is a type of exercise that does not call for any degree of alertness, originality, or first-hand observation on the part of the writer. The vagueness of the assignment and the consequent freedom of treatment may be a dangerous temptation for the inexperienced writer. At best, the general composition develops a certain faithfulness and industry in the performance of a perfunctory task. At worst, it begets a helpless state of dependence upon printed sources of material. Instead of welcoming as a challenge and an opportunity the discovery that nothing has been published on a given subject, the writer who has fallen into the dependent attitude simply gives up in despair.

STUDENTS RECEIVE SPECIFIC ASSIGNMENTS

Contrast with the dry, academic, general discussion type of writing just noted a specific assignment for a real technical article. Instead of "Concrete Buildings" and the Reader's Guide, the student is given the following instructions:

(A)

Mr. ————, engineer for the ———— Construction Company, a local concern, has recently designed a new type of adjustable shore. Write this up in a crisp news article as if for publication in the (name of a technical journal). Include photographs or sketches. Not more than 600 words.

Or, instead of the general topic "Asphalt," which would probably drive him to the Encyclopedia Britannica, the student is given some such suggestion as this:

(B)

The ———— Commission has just made a series of tests on a half mile of road paved with Kentucky rock asphalt. Give full details of the construction of this road and of the nature of the tests in an article for ————. Get photographs, curves, and tables of data. About 1500 words.

The foregoing typical assignments are specific problems in writing, and because they are definite, tangible and vital they arouse interest in the student—a thing which the vague injunction to write a "composition" rarely does. Still more interesting and beneficial than these assignments or "stunts" are the projects which the student makes out and completes on his own initiative.

Developing "Nose for Copy"

Using assignments like A and B as suggestions, and following some models which have been studied in class, he develops a "nose for copy" and is able to write a variety of articles from his immediate observation or experience. Students who take the co-operative course are particularly fortunate in this regard, for their alternate bi-weekly periods of work in the practice of engineering constantly afford suggestions for technical articles, ranging all the way from shop kinks or field and office notes of less than 500 words to long articles of the descriptive or the report type, which may run to 4000 words.

Many of these articles are actually published, but whether they are or not, the stages of their preparation are the same. The student gets a promising idea, decides upon the scope of a possible article, and tests his subject for the requirements of live interest and engineering value. Then by means of the *Engineering Index*, the *Technical Arts Index*, and the indices to the most likely magazines he learns whether or not articles have been written on the phase of the subject which he proposes to discuss. Unlike the dependent writer of a "composition," he rejoices on finding that nothing has been published on the subject, and that his article will not therefore be a duplication of any previous one.

Arrangement of Material Studied

The originality and engineering value of his idea are further tested by the criticism of his fellow-students and technical instructors, to whom he presents the material in co-ordination classes. He is now ready to consider the type of article which he will write, the arrangement of his material, the points which he will feature or emphasize, the use he will make of photographs or sketches, and various other matters relating to the organization of his article. Although most editors prefer to supply headings themselves, the writer will find it worth while to get a title which indicates as clearly as possible the subject and the method of treatment.

By giving careful attention to all these preliminary matters he will have greatly simplified the actual writing of his article. As a rule, however, he will find it necessary to revise his first draft, and especially to work over his beginning to make it clear and direct, for long and formal introductions, of course, are entirely out of place in an article of this kind.

After he has fully revised the manuscript, has omitted unnecessary passages, and has smoothed the rough places, he is ready to put the article in proper mechanical condition. If he cannot typewrite it himself, he should see to it that the copy which the stenographer receives is legibly written and correct, and he should give explicit instructions as to spacing, centering, and other details which will improve the appearance of the manuscript. At the University of Cincinnati no credit is given for copy which does not conform to certain mechanical standards.

To follow an article through these various stages to its completion is by no means an easy task, but the student realizes that it is a profitable one, and because it is in all respects his own work he takes interest and pride in seeing that it is well done. Many short articles are much easier to prepare than would be suggested by the foregoing outline, but whether the successive steps are taken quickly or slowly, all these matters should be given attention. There is nothing better for developing mental alertness and skill in writing than the rapid preparation of a variety of articles. It is more than a coincidence that a large proportion of literary men have served some kind of journalistic apprenticeship.

Articles Classified by Types

Without entering upon a minute classification of technical articles, we may note, in passing, the principal types and their relative importance to the young writer. Broadly speaking, the articles which make up the body of the average technical magazine may be grouped under three heads: Discussion, report, and descriptive articles. The first of these includes editorials and letters expressing opinion, but refers chiefly to long articles on general subjects, the style and method of treatment of which may vary according to the author's discretion—and he is assumed to have reached the age of discretion. Discussions of articles by persons of long experience, mature judgment, and known general fitness to deal with a subject are always in demand, and properly so. Anyone would be glad to read a discussion article by Howard Coffin on "Industrial Preparedness," by Samuel O. Dunn on "Government Ownership of Railroads," and so on. Likewise, editorials and signed letters of opinion in the more prominent journals may be safely assumed to be thoughtful, suggestive, carefully reasoned articles. Except as an exercise, however, the discussion type of article should hardly be attempted by the beginner. He is not in a position to write editorials, unless for his college paper, and his sense of proportion should restrain him from offering either letters of opinion or long discussions as contributions to a technical journal.

Report Type of Article

The report type of article, though less common than the others, deserves special notice because of its scientific character. In form it resembles the reports of laboratory tests which students are often called upon to make. That is, it consists of a statement of the object of the investigation; the theory on which the tests were made; the apparatus used; the procedure; the results, shown in tabulated form; and the conclusions reached.

This kind of article is usually technical in language and is addressed particularly to specialists. The data constitute its chief interest, and the written part is intended merely to state the purpose, vindicate the method, and explain the conclusions of the investigation. Because the writer must adhere rigidly to this outline, the report type of article is an excellent exercise in logical arrangement and clear, concise statement.

Students are sometimes in a position to write a report article; for example, one student at the University of Cincinnati based an article on a series of tests which he had made on a motorcycle engine by means of a blower fan. Another is now at work on an article resulting from tests of case-hardening compounds. As a rule, however, the actual preparation of such articles for publication is done chiefly by older men who have specialized in some phase of engineering research.

THE POINT OF VIEW

By far the most in demand is the descriptive type of article. Dealing as it does with a specific subject of timely interest, it constitutes a kind of technical reporting, in which the details are selected and presented according to the interest of a given body of readers. It often happens that the same occurrence, differently reported, may be found written up in the newspapers and in the technical journals, so that a direct comparison may be made between the methods of the respective reporters. If the occurrence is the failure of a bridge or a dam, the newspaper reporter features the human interest details, the loss of life and property, together with incidents such as narrow escapes and heroic rescues. He makes but little mention of technical matters and speaks of them only in general terms, such as the layman, and the reporter, can readily understand. The trained engineer who writes the same story for a weekly technical journal omits the spectacular incidents and the heart-interest scenes. Both in his language and in his illustrations he maintains the scientific point of view and presents the details of stresses and strains, foundations, and other technical matters. His writing is a specialized kind of reporting for a special group of readers.

A large proportion of the articles, particularly in the weekly technical journals, belong to the class of news stories which feature novel methods or equipment or the solution of difficult practical problems in engineering. These descriptive articles are written in a smooth, brisk, newsy style, and much of the thought is expressed in terms of significant photographs and sketches.

SHORT DESCRIPTIONS BEST FOR BEGINNERS

It is in the writing of such specific articles, especially in the short ones which deal with new "kinks" in engineering practice, that the beginner finds his best opportunity. A new method of locating trouble in the repair of electrical apparatus, a novel design for a foundry pattern, a device for hoisting materials on construction work—these are only a few suggestions of the sort of material which is most easily obtained and of the kind of articles most in demand. Since one of these brief descriptive sketches, if well written, has all the requisites of a longer article, a course in technical journalism may well center about such assignments, with only enough of the other types to familiarize the student with their chief characteristics. For the latter purpose and for exercise in phrasing, even the writing of original advertisements and "trade write-ups" may profitably be attempted, but the descriptive type of article should be the backbone of the course, just as it is of the technical journals themselves.

MANY STUDENT ARTICLES ACCEPTED

The students in the co-operative engineering course have had numerous articles accepted, varying widely in length and kind, the remuneration being from $3 to $35. There is no denying that the prospect of a check is a strong incentive for the preparation of an article—perhaps even stronger than the prospect of seeing one's name in print. Although the students would be given credit in English for these articles, whether published or not, it is an added satisfaction to know that their compositions have a commercial as well as an academic value. If some one were to offer cash prizes equivalent to the returns from these articles and stipulate that the award be left to a committee, I should feel inclined to ask that the money be diverted to some other purpose. It seems to me decidedly preferable that the technical articles written by students should continue to be tested on their merits by the normal, commercial standards for the acceptance of technical literature.

The following partial list of student articles accepted from time to time will indicate something of the variety of subjects and kinds of articles within the reach of engineering students:

Howard, W. R.—Screening and Concrete Plants for Building Use Gravel from Cellar Excavation. *Engineering Record,* Vol. 73, No. 15, page 483.
Descriptive type, based on experience in co-operative work. Photographs and sketches. 2500 words.

Todd, Fred C.—Floating Concrete Plant at Dam 39, Ohio River. *Engineering News,* Vol. 75, No. 14, page 661.
Descriptive type, based on experience in co-operative work. Photographs and sketches. 800 words. Contrast this with the sort of general discussion that would be written on the topic "River Improvement."

Phelps, S. B.—An Inexpensive Base-Plate Pattern. *The Foundry,* Vol. 43, No. 11, page 466.
Descriptive type, based on experience, "Shop Kink." Sketch, 500 words.

Oster, Eugene—Comparison of Lead-Sulphuric and Edison Types of Storage Battery. *Power,* Vol. 38, No. 21, page 716.
Combination of report and discussion type. Informal investigation of the two kinds of battery. Photographs. 4000 words.

Kuhlman, L. G.—Slate Drilling. *American Machinist,* Vol. 41, No. 6, page 247.
Semi-report type. Notes on experience in co-operative work. Sketches. 700 words.

Sharkey, W. E.—A Fan Method of Testing Motorcycle Engines. *American Machinist,* Vol. 41, No. 21, page 917.
Report type. An account of an investigation made partly for the co-operative form and partly as a laboratory test at the university. Photographs and sketches. 1600 words.

DaCamara, H.—Hoists for Reinforcing Steel. *Engineering News,* Vol. 73, No. 8, page 395.
Descriptive type, based on experience in co-operative work. Sketch. 400 words.

Government Reports on Stream Measurements in Columbia River Basin

A report presenting the results of co-operative work between the U. S. Geological Survey and the states of Washington, Montana and Idaho in measuring the flow of streams in 1913 has just been issued. The streams measured are those flowing into the Pacific Ocean in Washington, and the upper Columbia River and its tributaries above the mouth of the Snake River. The report, which may be obtained from the director of the United States Geological Survey, is known as Water-Supply Paper 362A, and is intended to be of service to engineers interested in utilizing the streams in this area.

Training in Thought Is the Aim of Elementary English Course as Taught at M. I. T.

Instruction Methods Presuppose That Clear Thinking Produces Clear Writing—Much Weight Is Given to an Appreciation of Relation Between Literature and Engineering

By **FRANK AYDELOTTE**
Professor of English, Massachusetts Institute of Technology

OUR elementary English course at the Massachusetts Institute of Technology, and especially that part of the first year's work which I have been asked to describe for the Engineering Record, might be characterized as an attempt to translate a certain demand, which is voiced on all sides by successful members of the profession, into a practical measure of engineering education. The question as to the kind of an English course engineering students should have depends upon the larger question whether one takes a narrow or a broad view of the vocation for which these men are being prepared. One may regard the engineer as a high class mechanic, not a scientist but a man who has mastered certain principles of science which can be turned to industrial uses, an expert, somewhat set apart from mankind in general, whose field is the world of dead matter and force, which he manipulates under the direction of other men without much regard to the general human significance of his work. On the other hand, one may regard him as a member of an intellectual profession which has for its object the control of the human as well as the material forces of nature, which has or is now forming a code of ethics according to which it will develop those sources of power in nature for the use of man—a profession the members of which, working in co-operation, consider themselves the trustees of the whole body of natural knowledge placed at their disposal by modern science, and who consider their duty to be to add to this knowledge and to use it for the realization of the highest aims of society.

TECHNICAL PROFICIENCY NOT ENOUGH

No reader of any large number of the essays and addresses in which practical engineers of the present day discuss these problems can be in doubt as to the direction in which they would have the profession go. That engineering is an intellectual profession, the mission of which is to be one of leadership in working out the problems of the modern world and in serving its highest interests, is the claim of many of the most distinguished engineers of the day; and these men demand from engineering schools not merely technical proficiency but also that development of character and that liberal cultivation, that capacity for original thought about human as well as material problems, which will enable technical graduates to play a worthy part in the engineering world when the period of their practical apprenticeship is ended and they are ready to take the places vacated by the present leaders.

This high conception of the profession of engineering is, of course, the fundamental justification of literary studies in a technical school; and it seems very important, in the practical teaching of English literature and composition, to make clear at the outset the bearings of this study on the wider usefulness of the engineer. The course about which I have been asked to write is planned with exactly that aim in view. The case for composition is in the end the case for literature. The widespread demand that our college men, graduates of technical schools and of colleges of liberal arts alike, should be better able to write and speak their mother tongue is really a demand that they have a better literary education. A man's writing reflects his habits of thought, and it is simply impossible to give him a cultivated style by any other method than by making him a cultivated man.

The average engineering student has too narrow and too mechanical a view of his future profession. He does not hold this narrow, materialistic, mechanical opinion of his calling as a result of thought and choice, but rather vaguely, from lack of thought, in obedience to a real or imaginary spirit of the age (perhaps one ought to say, of the age which is just now passing), which it has never occurred to him to criticise. He is ready to take hold of a broader conception with all the enthusiasm and ardor of youth once it has been pointed out to him.

MAKE STUDENTS THINK

We begin our study of English literature at the Institute of Technology with some consideration of the status and significance of the profession of engineering. Using as a basis some essays by practical engineers, we ask our students to consider the question whether engineering is a trade or a profession, what the difference implies, what is the meaning of professional spirit, how the ethics of existing professions differ from those of business or of the mechanic arts. We pass from this, again using as a basis for our work the writing of various men prominent in the engineering world, to the question of engineering education: What kind of training is necessary to fit a man to take a worthy place in the profession if it follows the lines laid down by the leaders of the present day? We ask the student to compare his own aims in entering a technical school with the professional demand as codified by Dr. Mann in his recent investigation of technical education conducted on behalf of the Carnegie Foundation and the five national engineering societies.

The object of all this work is to make the student think more seriously about his own vocation and the preparation he needs for it. Instead of telling him what he should believe we undertake to make him think it out for himself. We do not hand out his ideals to him for the reason that he will not act on them unless they are his own. We ask him constantly to discuss these questions as they look to him, orally and in his themes; they are, of course, questions on which it is very important that he should have an opinion and they are questions which excite his keenest interest.

Following the topic of engineering education we pass to that of pure science versus applied. Is the interest of the engineer solely in *how* things are done, or is it also in the *why?* What is the relation of practical engineering to scientific research? Is the work of the engineer the application of established formulæ to practical problems, or is it the solution of problems by scientific methods? As a basis of all this work we use essays by scientific men, and we ask the class as before to discuss in writing and speaking the application of these ideas to their own situation and their own studies.

RELATION OF SCIENCE TO LITERATURE

Finally we come to the question, What is the relation of science to literature? Here we ask the class to read a set of essays by scientists and literary men dealing with this subject and to work out in their discussion the relations between these two great bodies of thought which divide between them the material of our civilization. Each stage of this progress from engineering to literature harks back to all those preceding, and the whole ties itself together in a connected train of thought which these paragraphs will suggest, though, of course, enriched and diversified and illustrated in ways which cannot be suggested in so brief an outline.

The end of the half year's work is to give the student some notion of these alternative conceptions of engineering which I alluded to at the beginning of this article and some idea of what each implies. The question is not settled for him, perhaps, but it is opened. There is a real connection between the various problems with which he has been confronted. That conception of engineering which tends to divorce it from literature and from human problems, on the one hand, tends to divorce it from science on the other, tends to make it more of a trade than a profession, tends to limit the usefulness of the engineer to society by restricting him to the performance of merely mechanical tasks. Even the elementary student will see this, especially when he hears it from the mouths not merely of his English teachers but of practical engineers as well. He will see it and, in most cases, he will form for himself a broader conception of his calling as one dealing with human as well as material problems and needing for its practice a humanistic as well as a technical training. He comes to realize the intimate connection of the work he has chosen with science on the one side and literature on the other. He conceives himself as having a place in the world not only as a money-maker but also as a man. He is brought to the point where he has some conception of literature as a comment on life, as the collected wisdom of the race for the solution of its problems, as one expression of that beauty which makes life worth living.

HOW ENGLISH COURSE IS CONDUCTED

Ideas of this kind sound very "theoretical" and very far from practical class work in a practical engineering school. They may seem to the average reader all well enough for a lecture on poetry, where the lecturer may be allowed to say somewhat more than he means for the sake of emotional effect, but likely to pass high over the heads of technical students. As a matter of fact lecturing about them is the last thing we do. I can illustrate this by pausing for a moment to indicate more in detail how our work is conducted day by day.

Let us take, for example, the point with which we begin, the engineering profession. On the first day of the term, before the class has read anything on the subject, the instructor asks the question, What is engineering? All sorts of answers come back, mostly vague, or good answers quoted from somewhere but vaguely understood. Without saying dogmatically what is wrong and what is right (we dogmatize very little from one end of the course to the other), the instructor follows the first question with others: What is the difference between an engineer and a carpenter, or a plumber, or a research professor of chemistry? Is engineering a trade or a profession? What do these terms imply? What makes medicine a profession? As a result of an hour of such discussion, which is likely to wax very hot, the class is ready to read essays on the subject by engineers with avidity. These essays are taken up in class one by one and their bearing on the previous discussion brought out.

"LIVE" TOPICS FOR THEMES

For a theme the class may be asked to explain the difference between some mechanic and some engineer whom they know in the flesh. Or the different members may state more carefully rival points of view which they have argued about in class. All this discussion serves two ends: It trains the men to think more clearly, criticising their own hasty opinions, and to say carefully and exactly what they mean. And the result of all of it, carried through the whole list of topics, is to build up in their minds a body of ideas which they would never catch from lectures or from reading unaccompanied by discussion. The function of the teacher is to direct the discussion and focus it upon the important issues. If he gives his opinion it is as an individual rather than as a source of authority. His purpose is to stimulate and bring out differences of opinion, objections, and contradictions, that the class may try them and decide on their validity. This method has more in common with that of Socrates than with that of the typical German professor. It is not an easy way of teaching, but it is extremely effective.

COLLECTION OF ESSAYS USED

The volume of essays on which this work is based is arranged according to topics, with several essays under each, in the order in which I have taken them up. They are (excluding the first), "The Engineering Profession," "Engineering Education," "Pure Science and Applied," "Science and Literature" and "Literature and Life." This last section contains half a dozen essays illustrating in elementary ways the idea of literature as a "comment on life," and this forms a kind of summary of all that has gone before and as well a direct preparation for the further study of literature in the second year.

The first section of our collection has for its title "Writing and Thinking," and that title will suggest the method of the composition work which accompanies the reading. That work is based on the principle that the first rule of good writing is clear thinking. We grade our themes primarily on the ideas expressed in them.

We do not neglect faults of expression, but our ideal is one of content as well as of form. Where faulty expression is due to careless thinking, as in most cases it is, the trouble is traced back to its source.

For composition work of this kind the ideas about engineering and literature which we have been developing make admirable material. The men are interested and stimulated by them. The differences of opinion which arise make them eager to talk and to write. These conditions, the fact that they have something to say and the desire to say it well, are most important for effective work in composition. Of course, the men are unequal. It cannot be maintained that all students do well in such a course as this. To a certain type of mind the work seems "up in the air," with nothing tangible to learn and repeat, only ideas to discuss. The best students take to it keenly; the average men show marked improvement in the care with which they read and in the clearness with which they talk and write, while that student is dull indeed who does not produce some themes which are real expressions of his own thought and of his own personality.

INDIVIDUALITY ENCOURAGED

This work we make markedly individual throughout. We encourage independence and try to be patient with every point of view. Every effort is made to induce the student to think for himself. To this end we find a large number of personal conferences, which are a tradition of the English Department at the Institute, of the utmost value.

Work of the kind which I have just outlined seems to us, as I have said elsewhere, to have more value for strictly technical purposes than a course occupied exclusively with what is called "technical writing." No matter what the subject to be discussed the problem of writing is much the same. The student who can think straight, who can handle complicated ideas, who can balance arguments and marshal them to the support of his conclusions, can handle any technical subject within the range of his technical ability.

This does not mean that the student will not get great value from instruction in technical writing.

COMMON SENSE, PERSPECTIVE AND IMAGINATION

There are, of course, tricks in every trade, but the tricks are much easier to acquire and much less important than general intelligence. There is no "foolproof" method of writing engineering reports. An engineer who relies on a stereotyped form will turn out a machine-made product, devoid of real vitality. The problem is one of common sense, of perspective, of power of clear thought and clear expression, and of imagination to grasp the point of view of the man who is to read the report.

But the value of the work I have described is not limited to its bearing upon the actual writing which the engineer must do in the practice of his profession. Even more important is its educative value to the man, the approach it gives him to literature, the intellectual interests which it opens up to him, not as matters foreign to his work but as vitally connected with it. If the engineer is to have his full value to society he must view society broadly and address himself to the solution of its problems, human as well as material. In the education of this broader engineer, whom society so badly needs, the study of the mother tongue must be more than the acquirement of facts or a superficial accomplishment; it must be a training in thought, the influence of which is to clarify and humanize the student's character and his aims in life.

Old Piers Struck in Driving Coffers for New Ones Prove Watertight

Overturned Masonry of Bridge on Susquehanna River Carried Out by Johnstown Flood of 1884 Still in Good Condition

By F. P. KEMON
Atlantic City, N. J.

STONE piers that had lain at the bottom of the Susquehanna River since they were overturned by the Johnstown flood in 1884 were so well preserved that they were used as part of the cofferdam walls in building a railroad bridge at Milton, Pa.

The bridge, built for the Philadelphia & Reading Railroad by the Robert Grace Contracting Company, of Pittsburgh, was described in the Engineering Record of May 20, 1916, page 676. In building the cofferdams, sections of the steel sheeting struck these piers, which were part of an old bridge washed away 32 years before.

MASONRY OF PIERS OVERTURNED IN 1884 STILL WATERTIGHT

As the piles could not be driven into the piers, the pumps were started after the piles were driven as far as possible. Practically no water leaked through the old masonry, showing the remarkably good condition of the old mortar. Some of the piers covered about two-thirds of a cofferdam and were broken up with great difficulty. Even after they had been torn away to the edge of the cofferdam and excavation carried 12 ft. below the foot of the piling, the remaining wall was still watertight.

Tests Made to Determine Lateral Resistance of Wire Nails

Results Reported of Part of Extensive Investigation at Forest Products Laboratory Into Strength of Various Kinds of Joints

By THOMAS R. C. WILSON
Engineer in Forest Products, Forest Service

AS A PART of a rather extensive project dealing with the strength of various kinds of joints and fastenings, some tests have been made at the Forest Products Laboratory, Madison, Wis., to determine the resistance to lateral forces of several sizes of common wire nails. This series is not yet complete, but it is thought that the results so far secured may be of interest.

These tests were made on the larger sizes of wire nails (30d. to 60d.), driven into thoroughly air-dry (average moisture 13.8 per cent) longleaf pine of fairly good quality. Data on the strength of the timber are given in Table 1. Table 2 gives the average results—slip, load per nail and load per pound of nails both at elastic limit and at maximum load. Figs. 1 and 2 show the size of the test specimens and the arrangement of the test sets in the machine. For convenience of reference the piece through which the nails are driven is called the "cleat" and that receiving the points of the nails the "block." In order to prevent splitting, 3/16-in. holes were bored in the cleats for each nail. The blocks were not bored. Care was taken not to place any of the nails in checks, knots, or other defects or irregularities.

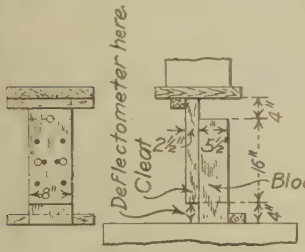


FIG. 1
Timbers with grain parallel loaded parallel to grain.

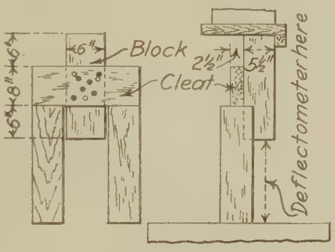


FIG. 2
Timbers with grain at right angles to each other.

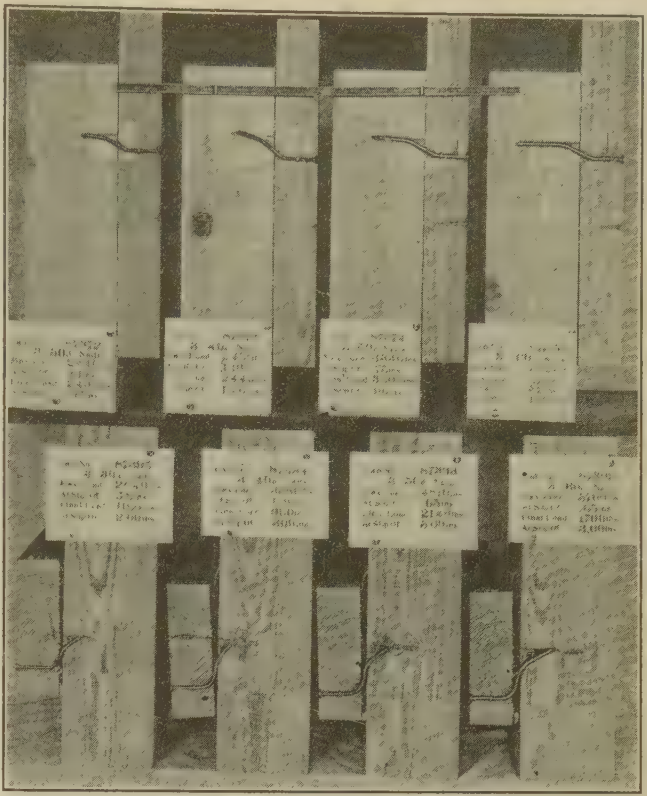
FIGS. 1 AND 2—DIMENSIONS AND DETAILS OF 6-NAIL JOINTS

Open circles mark position of nails for three-nail joint. In Fig. 1 cleat is shifted 8 in. endwise.

TABLE 1—COMPRESSIVE STRENGTH OF TIMBERS COMPOSING JOINT

	Strength of timbers, in pounds per square inch			
	Parallel to grain*		Perpendicular to grain†	
	Block	Cleat	Block	Cleat
Timber for tests, Fig. 1........	6,550	8,340	875	1,315
Timber for tests, Fig. 2........	7,850	7,850	1,025	1,425

*Maximum crushing strength from tests on 2 x 2 x 8-in. specimens.
†Fiber stress at elastic limit from tests on 2 x 2 x 6-in. specimens.



BENDING OF NAILS RESULTING FROM TESTS FOR LATERAL RESISTANCE

The following points have been noted from these tests and results. They may not apply to other sizes of nails, species of timber, thicknesses of cleats, or depths of penetration of nails.

1. The elastic limit is quite well defined and at a comparatively small deformation. Ability to absorb shock or impact is measured by the product of load and deformation, and to insure safety it is essential that both be kept well within the values at the elastic limit. Consequently this small deformation at the elastic limit points to the need for caution in the use of nailed splices where subjected to shocks such as are imparted to scaffolding, staging and other temporary construction by moving loads and the vibrations of machinery.

No definite relation between size of nails and deformation at the elastic limit is apparent.

2. The averages show greater loads per nail in six

TABLE 2—LATERAL RESISTANCE OF NAILS IN AIR-DRY LONGLEAF PINE

		Load, in pounds				Slip, in inches	
		Per nail		Per pound of nails			
Character of joint	Size of nail	At elastic limit	At maximum load	At elastic limit	At maximum load	At elastic limit	At maximum load
Timbers with grain parallel, load parallel to grain[1]—Fig. 1..............................	30d	355	779	8,520	18,700	.021	.54
	40d	394	845	7,100	15,220	.026	.58
	50d	450	1,261	6,300	17,660	.019	.69
	60d	422	1,144	4,640	12,580	.018	.70
Timbers with grain at right angles, load parallel to piece receiving points of nails[2]—Fig. 2.....	30d	333	783	8,000	18,790	.034	.88
	40d	389	1,125	7,000	20,270	.028	1.08
	50d	544	1,615	7,620	22,600	.036	1.18
	60d	589	1,644	6,480	18,080	.039	1.32

[1] Each value based on four tests of 3-nail and four of 6-nail joints.
[2] Each value based on two tests of 3-nail and two of 6-nail joints.

out of eight cases for 3-nail than for 6-nail joints. Individual tests are far from consistent in this respect, and it seems probable that the load per nail is independent of the number of nails in the joint.

3. It might be expected that increasing the size of the nail would increase the strength of the joint. That this does not always happen is shown by the fact that in average load per nail, both at elastic limit and at maximum, as given in Table 2 for nails in timbers parallel to each other, 50d. nails excel 60d. Moreover, in efficiency per unit weight the smaller nails seem in general to have the advantage.

4. It would also seem that the nails had greater holding power when the timbers cross each other than when they were parallel. If the better quality of the timber used in the first-mentioned tests be taken into account it seems probable that the direction of the cleat with respect to the block has little influence on the loads. However, the deformation or slip, both at the elastic limit and at maximum load, is consistently and appreciably greater when the timbers cross each other.

DIRECTION OF LOAD

It would seem reasonable to expect that the direction of the load with respect to the grain of the block would have more influence on the results than does the direction of the cleat with respect to the block. No data on this point are available, as in all the tests made the load was parallel to the grain of the block.

One test set with each size nail and each of the two relative directions of timbers, sawn through in the plane of a nail, is shown in the photograph. These pictures are not quite comparable, since the tests shown in the upper row were discontinued soon after passing the maximum load, while those in the lower row were continued until the load decreased to approximately one-third the maximum.

Oregon Is Confronted by Unusual Highway Problem

State Engineer Calls Attention to the Magnitude of the Work and Suggests Division of Authority

OREGON, with a population density only one-seventh that of New York State, has practically the same mileage of state and county roads. The present condition of these roads probably parallels that of its eastern sister before the advent of the automobile. Oregon's topography, on the other hand, presents an unusual obstacle to easy road-building; yet the problem must be faced and solved if the state is to maintain its progress, according to John H. Lewis, state engineer, from whose address before the Commonwealth Conference, held in Portland, Jan. 3, the following matter has been abstracted.

ESTIMATE OF COST LARGE

Estimated on the basis of economy, $75,000,000 would be required to bring the 3500 miles of strictly state highways up to modern standards. This is exclusive of roads within government reservations. An additional $160,000,000 would have to be spent by the counties to construct the secondary, or county, roads, of which there are about 8000 miles. No estimate is made of the cost of building 33,000 miles of local or district roads. These figures put the completion of the work rather far into the future; but it is expected that measures will shortly be taken to put certain main traveled roads into condition so that they may carry year-around traffic.

Chief among the trunk lines is the Pacific Highway, running from Portland to the California line, a distance of 350 miles. Of this, 26 miles is paved, and a still greater length is surfaced with crushed rock or gravel. There are certain stretches, however, which are impassable during the winter months.

Other designated main routes, such as the John Day Highway and the Coos Bay-Florence-Eugene Highway, have short sections where no road has even been surveyed. Were these sections opened and put in condition, the distance between important points would be considerably shortened and convenient outlets afforded—for instance, from the Willamette valley to Coos Bay and Umpqua and Siuslaw harbors, where extensive improvements are nearing completion.

NECESSITY FOR STATE CONTROL

It is recognized, however, that any highway upon which state funds are to be expended should be designated by the legislature, at least as to the cities and towns to be touched. Only in this manner can the decision remain free from small local influences and the results serve the commonwealth as a whole to the most efficient degree. Similar reasoning suggests that the county courts have complete jurisdiction over the routing of such highways as naturally would be under their control.

Drawing on the experience of other states, the work even on county roads should follow the standards of materials, construction and accounting approved by the State Highway Department, and the cost of maintenance should fall on those benefited.

Work of this importance and extent demands efficient state and county organization. While the purely executive work of construction could be left to the counties, the technical department, Mr. Lewis believes, should be maintained by the state.

Traffic Regulation and Road Repairs Under Modern War Conditions

Junior officers of the French Army, many of whom in private life occupy high positions in business, seem to have adapted themselves swiftly to the new life so different from their regular occupation. At every road intersection one of them is posted to direct the traffic, and they do so with all the efficiency of the members of a city police traffic squad. Never during his sojourn with the French armies has the correspondent of the Associated Press observed any serious congestion. Occasionally a German long-range gun will tear great holes in the roads in the endeavor to prevent reinforcements coming up or the approach of ammunition columns. At once large squads of men supposed to be enjoying a rest from the rigors of the front line are put to work to fill the gaps with fresh macadam, and huge steam rollers appear to level the surface. Other men come on with tar-pails and brushes and coat the surface to prevent the rising of dust.

Making and Filing Valuation Maps—Part II

Requirements of Interstate Commerce Commission Entail Much Work, Which Should Be Carefully Organized—Will Result in Invaluable Uniform Records

By JAMES G. WISHART
Office Engineer, Chicago, Rock Island & Pacific Railway

[IN LAST WEEK'S ISSUE, *beginning page 263, the author discussed the government's requirements as to maps and profiles, the desirability of utilizing old filing equipment, and the Rock Island's method of making and filing right-of-way and station maps. In this issue he explains the somewhat different way of handling profiles, the organizing of the work and the value of the records being obtained.*—EDITOR.]

PROFILES are filed on the same system as the right-of-way maps. Cardboard boxes divided into nine sections, as shown in Fig. 5, are fitted into each compartment. These are made 12 in. deep, and each section readily accommodates a roll of the same length as the right-of-way maps. Diagram maps similar to those used for the right-of-way maps are placed on the inside of the door to each compartment. The numbering of the profiles is slightly different from that for the maps. The horizontal rows of profiles are lettered and the vertical rows are numbered. Capital letters are used for the current record profiles, lower-case letters for those which have been superseded and the letter V prefixed to capital letters for the office copies of the profiles filed with the commission in connection with the valuation.

The same letter and number are assigned to the three classes of profiles for the same portion of line. For example, the current profile for the line from Tiptop to Sagville is indexed H–7; the valuation copy would be VH–7 and the superseded profile h–7. The advantage of this system of numbering can be readily appreciated by any engineer, as the number of one class of profile being known, the other two classes may be found without reference to index or diagram map.

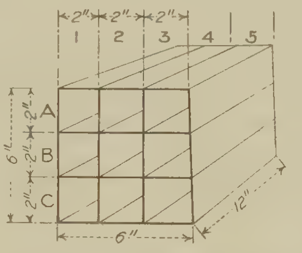


FIG. 5 — DIMENSIONS AND LABELING OF PROFILE CASE

No Card or Book Index Required

The principal advantage of the method of filing and indexing described is that no card or book index is required except for record purposes. Any right-of-way map, station map or profile can be instantly found, if in its proper place, if the state in which it is located is known. Filing by states eliminates the liability of having to change index numbers or shift tracings to different compartments in the future, as often occurs where filing has been done by operating divisions or other less permanent subdivisions of the system. No mention is made in the title of the name of the operating division or district.

Filing in tubes or boxes without the use of rubber bands or other forms of fasteners to prevent the rolls from unrolling preserves the tracings. The extra length of clear tracing cloth at each end serves as a wrapper and prevents the drawing from becoming soiled; and although some will object to the leaving of this extra cloth at each end of the roll, which at first appears as a waste, I have found that many benefits are derived from the practice. The saving of time alone when making blueprints and the continued possibility of securing legible prints from old tracings made in this way more than repay the cost of the additional cloth used.

Original tracings are placed in one set of cases to be used for current record purposes. Lithographic reproductions on tracing cloth, exact duplicates of those filed with the Interstate Commerce Commission, are filed, on the same system, in a separate set of cases assigned to valuation records, and are kept unaltered as a permanent record of what was filed with the commission. The labeling on the doors on these cases includes the word "Valuation" in addition to the standard wording.

Reproducing Tracings

In the commission's specifications a provision is made that the maps and profiles for filing with the commission may be made "by lithographic process, approved by the commission, on the best grade of tracing cloth." This proviso has enabled the railroads to save a vast amount of money, as the lithographic processes of reproducing tracings on tracing cloth have been developed to a high degree of perfection during the past few years. Reproductions are now made true to scale and of any size, either from parts of large tracings or from a number of smaller ones which may be matched together to form a single tracing in the process. Information shown on the originals may be eliminated in the reproductions, and information not shown on the originals may be added by means of inserts. The cost of these reproductions is much less than that of making tracings by hand, and compares very favorably with the cost of making brown or black line prints on cloth.

Schedules of Lands Made Separately

The information required by the commission in support of the schedule of lands owned is specifically stated, and typical forms of schedules are also shown on the specimen maps made a part of the specifications. In some instances railroads have been permitted to elaborate on this form in order to have it include additional data which later would prove of value to the company as well as the commission. The form shown in Fig. 6 is more complete than that shown by the commission, and has been found to cover all desirable points which should be considered in tabulating information of this kind.

To apply this schedule to the original tracings by hand would require almost as much time and labor as the making of the maps themselves. To eliminate this extra work for the draftsmen, the schedules are worked up, by the right-of-way tabulators, on blank forms in pencil. These pencil copies are then turned over to a stenographer, who types them on a thin white transparent paper, with a sheet of carbon paper reversed to imprint on the back of the first sheet, three or four carbon copies being made at the same time. The sheets are numbered with the index number of the sheet of tracing to which they apply. The first sheet, from which blueprints can be made, is sent to the reproducer along with the tracings, and is reproduced on the original tracings as well as on the reproductions. The other copies are used to supply the wants of the railroad and government land appraisers.

Land Records Invaluable

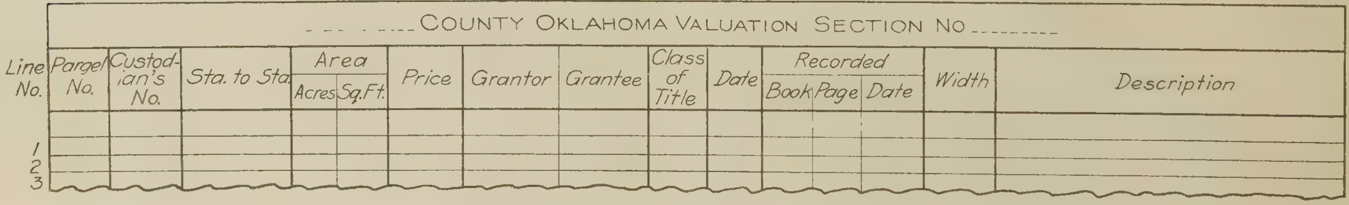
The complete and accurate tabulation of the title to all right-of-way and real estate owned by the company is one of the greatest benefits to be derived from the valuation work. It enables the land department to locate all parcels of land the title to which may be missing or clouded, and to take steps toward obtaining clear titles. It also enables it to locate all points where trespassers are encroaching on company property, from whom the necessary rentals can be obtained or their removal secured.

To save time in the drafting room, sheets may be used by the reproducer which have the border lines printed on them beforehand, and which have been cut to the proper size—12 x 56 in. or 24 x 56 in. respectively, for profiles or maps. It has been found, however, that the saving is in time only in using these sheets, as the labor cost of ruling the borders by hand is slightly less than the additional cost of the ruled sheets. To aid the reproducer in properly placing the map on the sheets, match marks, as prescribed by the specifications, the four corners of the border lines and the valuation index number are shown on the original tracing in pencil. The proper locations for the land schedules, titles and engineer's certificates are also indicated.

At the time the reproductions are made an extra set of maps is made and turned over to the land department, thus giving that department a complete set of tracings on which a record of right-of-way owned at present, purchased or sold in the future may be maintained, and from which blueprints may be made. From the maps of the more important cities still other extra copies are made on tracing cloth for the files of the division or district engineer.

Use Ink Liberally

In preparing the original tracings for reproduction, the draftsmen should be instructed to use plenty of ink, making the lines and lettering perfectly opaque. This will result in a tracing that will blueprint well, a feature that is desirable and which will make excellent reproductions. Care should also be taken in the selection of profile tracing cloth to see that a cloth is used on which the plate lines are clear cut and will produce distinct plate lines on a blueprint, this being a quality not possessed by all tracing profile cloth now on the market. For the sake of the eyes of those who work on these profiles the use of a cloth on which the plate lines are printed in green is recommended.



	- - - . - - - - COUNTY OKLAHOMA VALUATION SECTION NO - - - - - - - - -														
Line No.	Parcel No.	Custodian's No.	Sta. to Sta	Area		Price	Grantor	Grantee	Class of Title	Date	Recorded			Width	Description
				Acres	Sq.Ft.						Book	Page	Date		
1															
2															
3															

FIG. 6—THIS FORM FOR SCHEDULE OF LAND HAS BEEN FOUND TO COVER ALL DESIRABLE POINTS

The specifications permit the combination of track and land maps into one for towns where extensive and complicated property is owned, and the combination can be made without sacrificing the clearness of the map. While this may be satisfactory for the purposes of valuation and the use to which the maps will be put by the commission, it is certainly undesirable from a current-record standpoint, as it requires the carrying of the land schedules on the station track map with the accompanying parcel numbers on the face of the map, and in a measure subordinates the track and structure features, the recording of which is the real purpose of the station map. Wherever a large-scale station land map is necessary to show clearly the various parcels of property, it is advisable to prepare a straight land map without tracks and file it as a part of the right-of-way records.

Organization of Drafting Room

The organization in the drafting room for handling the valuation work during the period of preparing maps for filing should consist of several squads, each assigned to a special branch of the work, such as detailing right-of-way maps, tracing them, tabulating right-of-way title, correcting and retracing station plates, replatting and tracing profiles and putting the finishing touches on the reproductions. The new right-of-way maps are first detailed in pencil, the work being done in conjunction with the notes taken in the field by the federal chaining parties. After the government field notes have been applied, all differences between them and the old records reconciled, and the match marks shown for each sheet, the detail drawing is turned over to the tracing squad, which completes the tracings and checks the work of the detailers.

The government field parties do not take any alignment notes or land-line ties, and consequently it has been necessary to maintain a field party of three men to get this information on lines where insufficient data are found in the files to plat a new map. They also check the government notes where they vary to a great extent from the original maps. This party has proved a paying investment, as it has made possible the correction of many chaining errors discovered by the detailers in the government notes and has enabled the draftsmen to turn out more dependable maps than would have been possible otherwise.

The land tabulators carry on their work of compiling the ownership of property into the land schedule for the same territory as that on which the detailers and tracers are at work. The areas are figured and parcel numbers assigned by them either on the finished detail drawing or on the finished tracing. As rapidly as the tracings and land schedules are completed, blueprints of the maps and a copy of the schedule are made and forwarded to the land attorney of the commission for his use in compiling his report on right-of-way and real estate owned. The index maps made for each valuation section are platted on printed forms, these forms showing 1296 square miles or land sections on a sheet, the required number of sheets being matched together and pasted to form continuous sheets for tracing after the line has been platted. These forms are printed by a publishing company on a scale of ½ in. to the mile, and by their use the labor of laying out the section lines by hand is eliminated.

The profile squad and station-plat squad are engaged in either correcting the old tracings to agree with the new right-of-way maps or platting and tracing new ones. These squads have 7680 miles of profiles to trace and about 1000 station plats to redraw. A separate squad is assigned to the work of checking the tracings to see that all requirements in the specifications have been complied with before they are submitted to the government engineer for inspection and approval before reproduction, and also to touch up the reproductions before they are forwarded to the commission for filing at Washington.

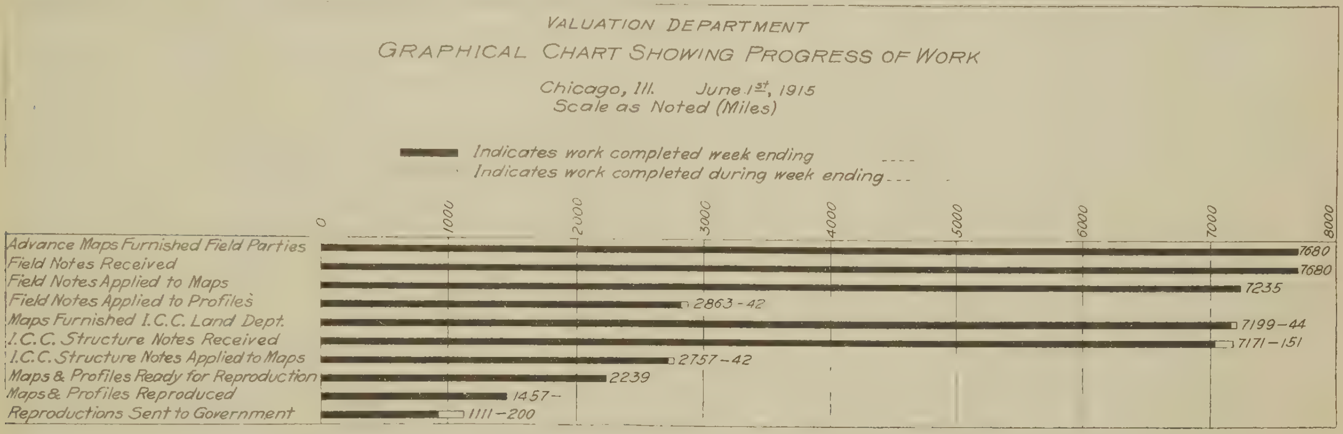


FIG. 7—GRAPHICAL REPORT SHOWS WEEKLY PROGRESS AND STATUS OF ALL BRANCHES OF DRAFTING WORK

All titles are printed on the reproductions and originals with a small hand-printing press, using standard styles of type and Keloe tracing-cloth ink. This method of putting on titles has proved so much more economical than handwork by the draftsmen that there is no comparison between the two methods. Titles for a complete valuation section, where the number of sheets, including maps and profiles, run as high as 200, can be applied in less than a day by one man. The work should be done by a man who has had experience in printshop work. Titles printed in this way, if allowed to dry properly, are practically as permanent as those applied by hand with India ink, and blueprint equally well. In addition they improve the appearance of a tracing very materially over the hand titles, and uniformity of titles is maintained throughout the entire set of maps.

Graphical Weekly Report

At the close of each week the valuation chief draftsman submits a graphical report showing the progress made during the week and the status of all branches of the drafting work. A facsimile of this report is shown in Fig. 7.

The land schedules are compiled to cover every piece of property occupied in any manner by the railroad company's facilities, either tracks, buildings or other structures owned or used by the company, the title or right to occupancy being thoroughly investigated in every instance. When turned over to the federal land attorney, these schedules are a complete record of every piece of property owned by the company or occupied by virtue of contracts, ordinances or other rights.

One of the most beneficial results of the federal valuation to the railroads will be, as shown, a complete record of the real estate, tracks, buildings and other structures owned by the railroads, and an entire set of maps and profiles drawn to uniform scales. This will be a condition that has not existed in the past on a large number of roads, and one that will constantly be appreciated especially in the engineering departments. To file properly these records, which have been obtained at heavy expense, is a question worthy of much study, and the system outlined will offer many advantages over various others now in use.

Illinois Sewage-Plant Operation Needs Better Attention

Winter Investigation Finds Equipment for Final Treatment Generally Out of Commission—Local Authorities Lack Knowledge

SEWAGE sedimentation tanks receive less intelligent attention in operation than any other part of the disposal plant. This statement and the further one that the whole operation of the greater number of sewage plants recently visited under winter conditions is lamentable are conclusions expressed by M. C. Sjoblom, assistant engineer of the Illinois State Board of Health, in a paper recently presented to the Illinois Society of Engineers. Ten plants were reported on, eight of which were visited in January. In all cases the installations provide for preliminary treatment by one or two-story tanks, and final treatment through intermittent sand filters, sprinkling filters or contact beds.

Practically none of the towns visited has an organized sewer department, and the responsibility for the care of the sewerage system and sewage-treatment works falls on the village council. Two of the cities have engineers who superintend largely the operation of the treatment works, but even here the work is apt to be hampered by financial obstacles and by having to accept such help as the councils will provide. In the majority of the towns there seemed to be a general feeling that the duties of the caretaker at a well-designed sewage-treatment plant are rather unimportant and that the plant should require only occasional attention. The operation of the plant has therefore in most cases been added to the duties of the local policeman or street commissioner, who can give it only a fraction of the time and attention necessary to obtain a proper effluent. Of the ten plants visited not more than three appeared to be properly cared for and to be giving satisfactory results in a general way, while in one of these the filter area is so limited that less than half the sewage can be given secondary treatment.

TANK TROUBLES NUMEROUS

Barrington has a combined system which affords house sewerage facilities for only a small portion of the population. The outfall sewer consists of a 10-in. inverted siphon having its invert 5 or 6 ft. below the flow line in the tanks which constitute part of the treatment works. Based on measurements made of the dry-weather sewage some time ago, the velocity of flow through the siphon is often negligible, and most of the time probably does not exceed ½ or ¾ ft. per second. Consequently organic wastes settle out in the siphon during normal flow, only to be washed later, in a septic condition, into the screen chamber.

The screen chamber was found to be completely filled with a slimy dark sludge which all but shut out the flow into the Imhoff tank. As the Imhoff tank is installed largely for the purpose of keeping the sewage from becoming septic, the object sought is thus defeated by the sludge in the screen chamber.

MISDIRECTED ENERGY

At North Chicago the plant consists of two septic tanks, a dosing chamber, sludge bed and trickling filters. During one day per week the sewage is bypassed directly into the small creek ordinarily receiving the filter effluent, and the contents of the tanks, including the sludge which has accumulated during the remainder of the week, are slushed directly into the same stream. The cleaning of the tanks requires the services of two men for a day each week. Thus the plant does not serve the purpose for which it was installed—not through lack of attention or faulty design, but through unintelligent and misdirected energy.

The other extreme was found at Downer's Grove, where the tank has not been cleaned for more than six years, and the retention period has been reduced until the crude sewage, with its fresh suspended and floating solids, passes directly through the tank. The plant here includes a septic tank, a dosing chamber and several small trickling filter units; but owing to the freezing of the dosing apparatus, which is rather complex in construction, only the tank is now in operation, and the crude sewage is discharged directly into the small creek which ordinarily receives the filtered effluent.

In all three of the towns where two-story tanks comprise a part of the treatment works it was found that large quantities of scum are permitted to accumulate in the sedimentation channels. At Olney this trouble arose from the fact that the plant is not provided with a means for the removal of sludge, and the authorities, through lack of knowledge as to the principles of operation, had permitted the sludge to accumulate until it filled the tank above the slots. The sedimentation channels acted therefore as poorly arranged septic tanks.

The dosing apparatus in practically all the plants appears to cause the attendants the greatest amount of trouble and worry. This apparatus, though supposed to operate automatically, needs daily attention, as there is no warning given when a siphon is going to lay off, and if not attended to regularly the flooding of some of the filter units occurs. Almost every plant attendant interviewed told of difficulties experienced in learning to remedy siphon disorders.

MOST FILTERS QUIT IN WINTER

None of the intermittent sand filters in the towns visited recently was in operation, on account of the cold weather, and only one of the plants, including trickling filters or contact beds—namely, that at LaGrange—was operating to give satisfactory treatment to all of the sewage. At Chicago Heights the contact beds are probably operated as efficiently as possible under existing conditions, but owing to their limited area and the inadequate size of the dosing apparatus, which cannot handle all of the sewage, at least half of the sewage is passed directly from the septic tank to a nearby creek which receives the filter effluents.

At North Chicago only a portion of the filter area was in use, as one of the dosing siphons was out of repair. At the Naval Training Station the trickling filters were completely submerged, due to the sewage in the effluent troughs being frozen. At Fort Sheridan the nozzles on several of the risers in the sprinkling filters were missing, thus permitting practically the entire flow of sewage through the few uncovered risers and little, if any, through most of the nozzles. At Downer's Grove the trickling filters were out of commission, on account of the freezing of the dosing apparatus, while at Pana only about half of the distributing troughs over the trickling filters were receiving sewage. In several instances, said Mr. Sjoblom, little if any better results are being accomplished than would be possible with a sedimentation tank alone, if intelligently operated.

WHO IS TO BLAME?

The entire blame for the deplorable state of affairs probably cannot be laid to any one person or department, Mr. Sjoblom thinks. It appears, however, that those chiefly to blame are the municipal authorities who, through the desire to keep down expenses, or more often through ignorance, simply instruct the policeman or street commissioner to care for the plant and then apparently feel that the responsibility has been removed from their shoulders. In a majority of these cases the officials seldom if ever visit the plants, and when complaints are made regarding nuisances often fall back on the statement that their plant is one of the most complete in the neighborhood and that they understood the plant was operating splendidly only a short time before.

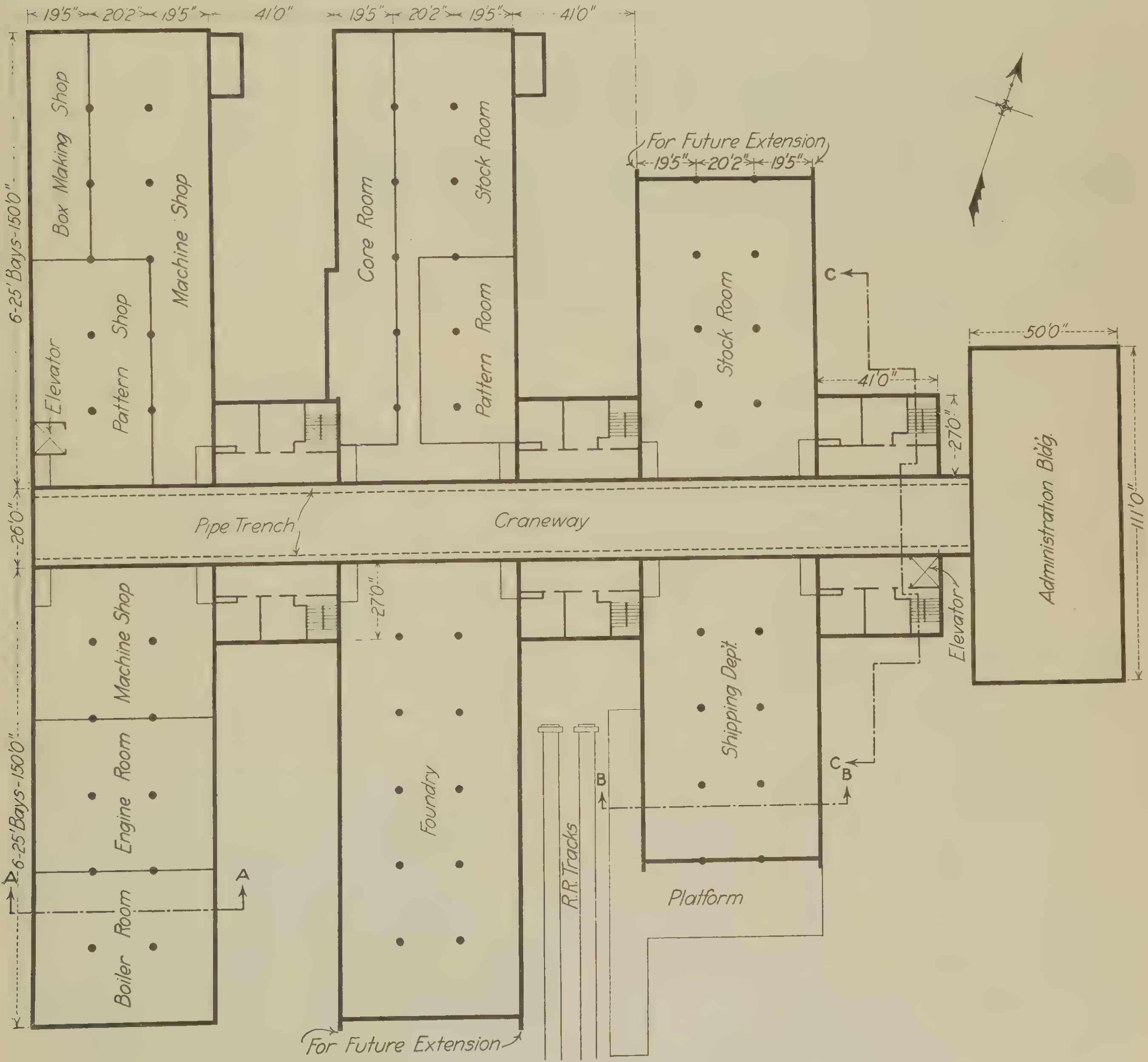
To what extent the engineer is to blame for this state of affairs is difficult to judge. If one is willing to take the word of some city officials or plant attendants, however, it appears that quite often the engineer has given few if any instructions as to the importance of careful supervision, and it is not strange that results have not been wholly satisfactory.

Where faithful and conscientious attendants are maintained they often give their work considerable attention and the plants are operated quite efficiently. As this state of affairs is the exception to the rule, however, it appears to Mr. Sjoblom that some means should be devised which would provide for the intelligent operation of all plants installed. To this end it was suggested that the city officials in engaging an engineer to design sewage-treatment works should also retain him to take charge of its operation for a year or more. In this way some man in the community could be trained in the duties connected with the plant. Another plan which might be practical consists in having the communities employ some competent engineer to make occasional visits to their respective plants and to see that the plants are being properly operated.

Factory Building Has Central Craneway with Lateral Wings

Manufacturing Plant in Flushing, N. Y., Planned for Efficient Handling of Materials—Modern Administrative Facilities Are Provided

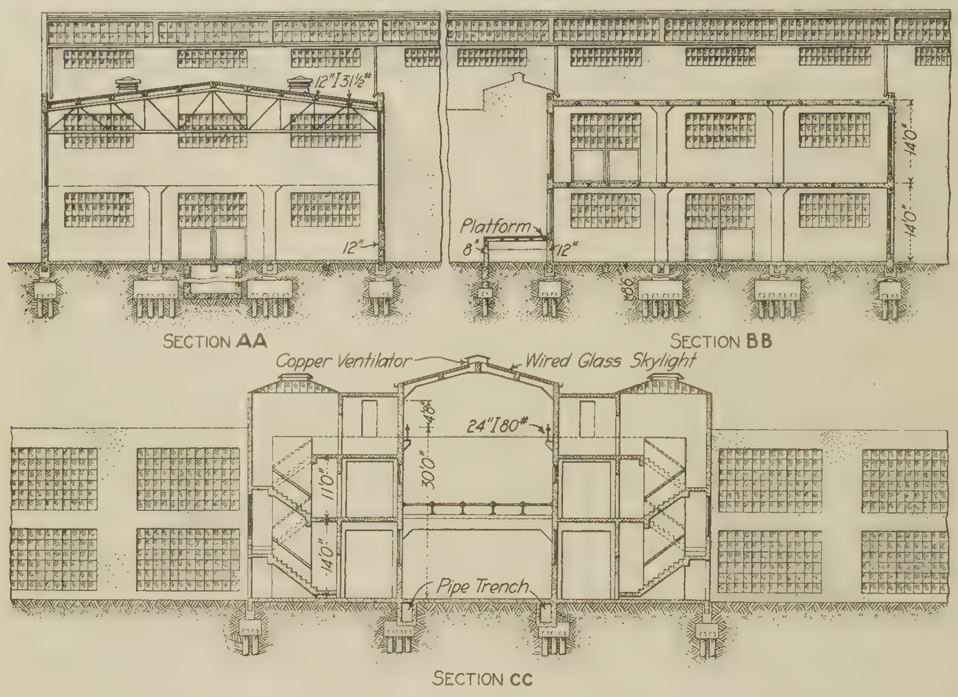
ONE of the most unusual layouts for a factory building yet used in this country is the type adopted for the new plant of the Nathan Manufacturing Company on Flushing Creek, Flushing, within the limits of New York City. Following a plan used for the Siemens-Halske factory in Berlin, Germany, a central craneway with lateral wings on each side makes the efficient handling of materials and central control a matter of great simplicity. This layout can be compared with the H-plan for the Sun Shipbuilding Company, described in the Engineering Record of Oct. 21, page 498. At the end of the craneway and directly connected with it is the administration building, containing every mod-



GENERAL PLAN—FIRST FLOOR OF FACTORY AND ADMINISTRATION BUILDING ern convenience for the welfare of the employees, including rest rooms, dining rooms, roof gardens, etc.

MARSH LAND REQUIRES PILE SUPPORT

The location of this factory on marshy lowlands near tidewater made the foundation and construction work unusually difficult. Materials could not be stored or moved over the site without special timber platforms, walkways or roadways, hence a single central concreting plant and tower were required. Piles, ranging generally from 30 to 60 ft. long, were necessary in every case where loads were supported, even for the light pipe lines crossing the property. Another special feature in this plant is the combination of steel roof trusses for the 59-ft. spans in the foundry and in the boiler and engine rooms with reinforced-concrete columns, which at the present prices of steel and with a concrete plant working on the site were found to be economical.



SECTIONS LOCATED BY PLAN ON PRECEDING PAGE SHOW DETAILS OF ARRANGEMENT

FOUNDATION DIFFICULTIES

Practically the whole of the 15-acre property is a treacherous marshy soil, consisting generally of about 4 to 5 ft. of peaty material above a soppy clayey silt. The silt is so wet and loose that in the transmission of pressure it acts as a fluid. The pressure increases and diminishes with the rise and fall of the tide, and varies to such an extent that the 18-in. bottom of a reinforced-concrete pump pit laid at low tide and allowed to set for a few days under water (the pit was filled to counteract the upward tidal pressure) cracked at high tide after the water was pumped out. In this saturated soil more than 6000 piles 30 to 60 ft. long were driven for all foundations for walls, columns, conduits, etc., and in many cases an exceptionally large number of such piles were driven to prevent future settlement.

Another difficulty in the laying of foundations was encountered in the fact that the muddy soil would not even support the concrete for capping the pile heads. It was found necessary to tamp in a 1-ft. layer of cinders, cover these with 12 in. of plain concrete, and cast the reinforced concrete upon this as a base. A cinder fill averaging about 3 ft. deep is being spread over the entire site.

The property is located on Flushing Creek near the Long Island Railroad, between Amity and West Grove streets, with the administration building facing on Lawrence Street. The administration building, 50 x 110 ft. in plan, is connected to the central craneway, which is 26 ft. wide and 312 ft. long, by inclosed passageways 11 ft. long. The craneway is 15 ft. higher than the factory buildings, with the entire roof glazed and a row of sash in both walls above the factory roofs, giving exceptional light. On each side of the craneway are three wings running north and south, nearly 60 ft. wide, two 150 ft. long and one 100 ft. long, as noted in the first-floor plan here reproduced. Between the wings are spaces or courts 41 ft. wide, which insure ample daylight for these two-story parts of the factory. At the intersection of the craneway and these courts are six short extensions in which are located locker rooms, toilets and stairways.

The advantage of the layout adopted lies in simplicity of supervision and in the ease of handling materials by the crane in the central artery of travel, where the raw materials and the various products in different stages can be shifted from floor to floor or from one side to the other. Cost-keeping becomes an exact science, inasmuch as the individual processes may be isolated, although the finished product is completed under one roof.

The location of the different fabricating shops, etc., is indicated on the first-floor plan. The upper floors are used for machine shops, toolroom, blacksmith shop, assembling room, testing, drafting, accounting and research departments.

MATERIALS DELIVERED BY WATER

Materials are delivered by water on Flushing Creek, about 300 ft. west of the factory building, by the siding shown, which connects with the Long Island Railroad, or by auto trucks. A one-story building, 40 x 150 ft., is located at the waterfront, to be used for a storehouse, pump room and tank room. This building, like the main factory buildings, has reinforced-concrete walls and a composition roof carried by concrete slabs on steel trusses.

A short distance to the south of the main factory, located near the boundary of the property, is the garage to house the auto trucks used by the company—a building 52 x 123 ft. in plan and two stories high, built of reinforced concrete.

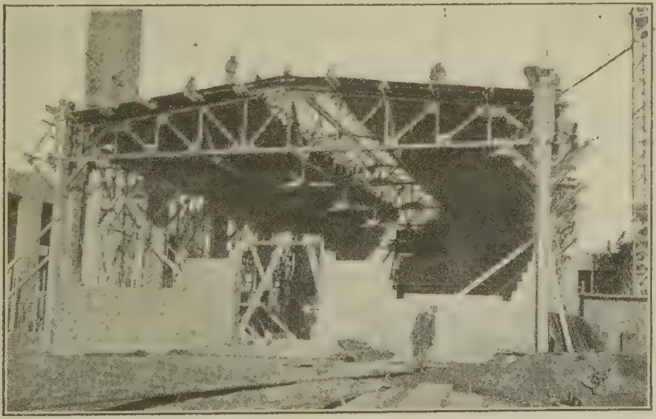
Modern facilities for the comfort and welfare of the employees are embodied in the layout of the administration building. The main entrance, with bronze-covered doors, leads to a central lobby and stair hall extending through the building in line with the craneway, or central artery of the factory proper. Offices, selling room, toilets, etc., occupy the greater part of the three-story structure except the third floor, where rest rooms and a large dining room, with a roof garden on each side, make the building distinctive as an especially well-designed structure for its purpose.

Above the main dining room is a tank room for housing a 45,000-gal. tank. Passageways at each floor connect with the craneway of the main factory buildings. A complete view of the factory operations will be obtained from balconies in the central craneway. In this craneway at the second-floor level are three passageways of full-panel width, connecting the wings on the two sides and the administration building. Material is transferred from floor to floor and from one wing to another by the 2 and 6-ton cranes carried by I-beams on the reinforced-concrete wall brackets shown in one of the cross-sections.

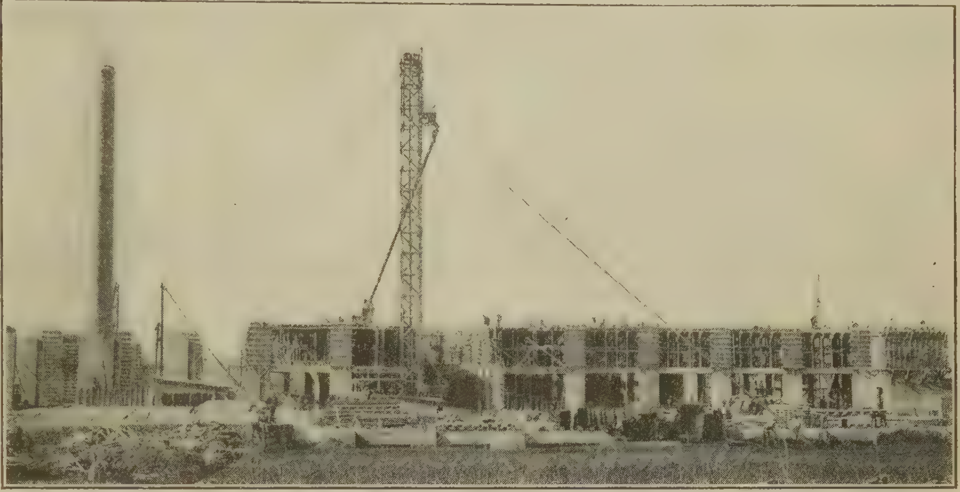
Instead of using steel columns to support the steel roof trusses of two wings in the southwest corner, reinforced-concrete columns or pilasters were adopted for economy, owing to present high prices and slow deliveries for structural steel, and because the concrete plant and full equipment were on hand for concreting these columns economically.

Construction from Central Tower

In view of the unfavorable conditions of the ground, and the consequent necessity for special timber platforms and passageways for storing and moving the concrete materials, it was necessary to adopt a single central concrete plant with a tower 130 ft. high located near the craneway, using long chutes to the various parts of the main buildings. As seen in one of the photographs, this tower was located as near the center of the group as possible without interfering with the erection of the craneway walls. The scheme worked very successfully. After the slow and difficult work on the foundations was completed in the latter part of August, 1916, up to Jan. 6, 1917, 20,000 cu. yd. of concrete was placed with the single central plant and two small movable mixers. The total yardage for the plant will amount to 27,500 cu. yd.


CONCRETE WALLS AND STEEL ROOF TRUSSES IN WINGS

The Nathan Manufacturing Company is spending approximately $750,000 on this plant, not including the cost of land. It has filled in the open sewer originally crossing the site and provided a closed diverting sewer across its property to connect to the Amity Street sewer. After placing the cinder fill it is expected to plant grass and shrubs to make attractive surroundings for the workers. The plant will manufacture locomotive injectors and fittings. It was designed by Eugene Schoen, architect, and the construction is being carried on by Rheinstein & Haas, Inc., of New York City, the general contractor.


SINGLE CONCRETING TOWER SERVES ENTIRE CONSTRUCTION ON MARSHY GROUND

Columns on left will support roof trusses of foundry building. Craneway is on right of tower.

Defines Duties of Reclamation Service Officials in Denver Office

As there has been some misconception of the duties and responsibilities of the officials in the Denver office of the U. S. Reclamation Service, and some of the project managers have failed to realize that they are in sole and responsibe charge of all administrative and engineering work under their respective projects, the January *Reclamation Record* gives the duties of the various men in the Denver office. Of the chief of construction it states that he represents the director and chief engineer in the field and is in charge of all matters relating to the management and execution of the work in the field and all employees engaged in the construction, operation and maintenance of the projects and works incident thereto. All instructions issued from the office of the chief of construction on administrative and engineering matters relating to the management and execution of the work in the field are issued over the signature of the chief of construction or his assistant. Project managers are in sole and responsible charge of all work on their respective projects and such territory contiguous thereto as may be assigned by the chief of construction.

Proposes to Build High-Level Bridge Over Hudson Ten Miles South of Albany

New York Central Plans Extensive Connecting Railroad and Mammoth Yard to Avoid Albany Dip, Drawbridge and Pusher Grade

IT IS EXPECTED that the U. S. War Department will grant a permit to build a high bridge over the Hudson River, 10 miles south of Albany, thus removing the last obstacle to the construction of the Hudson River Connecting Railroad. The Hudson River Connecting Railroad is probably the most important single project undertaken by the New York Central Railroad in twenty-five years, with the exception of the Grand Central Terminal reconstruction and the electrification of the terminal zone, and is expected to effect a great saving in the operation of the New York and Boston stems of the New York Central system. The improvement, which is primarily designed for freight service, involves a high-level connection from the Boston & Albany Railroad and an easy approach from the Hudson division of the New York Central on the east bank of the Hudson River to the West Shore Railroad on the opposite bank. It also involves a mammoth freight yard. It will avoid the pusher grade out of Albany for westbound freight traffic and the dip for all Boston & Albany freight business in both directions. It will also remedy the drawbridge congestion at Albany and the inadequacy of the West Albany yard, which cannot well be expanded.

Present Operating Conditions at Albany

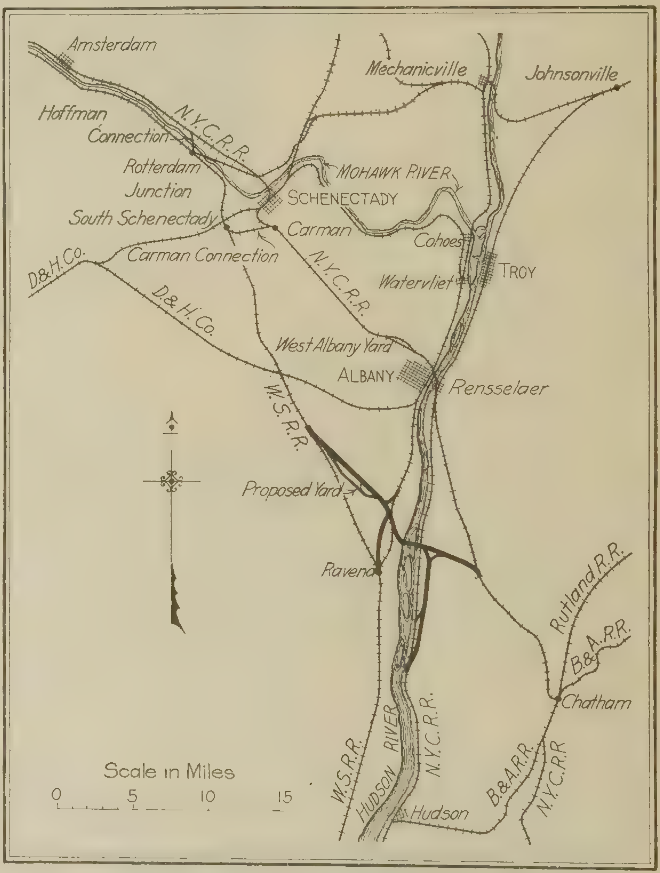
The wide scope of the project will be made clear by the accompanying railroad map of the vicinity of Albany. Westbound the New York Central follows the Hudson River north on easy grades from New York to Albany. It then turns westward and makes a 4-mile ascent of West Albany hill, partly on a 1.7-per cent grade, necessitating pusher engines. On the brow of this hill, partly on the grade, is the West Albany freight yard, which serves both the New York Central and the Boston & Albany. Though this is a large hump yard, it has been outgrown by the business and the site is not suitable for expansion. Continuing westbound to Schenectady, the line descends on a 0.75-per cent grade. The summit is 80 ft. above Schenectady and 303 ft. above Albany. West of Schenectady the road proceeds along the north bank of the Mohawk River.

Eastbound from Albany the Boston & Albany leaves the New York Central at Rensselaer, just across the Hudson River from Albany, and runs south along the hillside, ascending on an average grade of about 1 per cent and gradually working away from the river. At Brookview, however, 8 miles south of Albany, the line is less than 2 miles from the river, while at Chatham, 23 miles from Albany, it is only 9 miles away. At Chatham it turns eastward.

Both the New York Central and the Boston & Albany cross the Hudson River at Albany on two double-track drawbridges, one for passenger business, the other for freight. The handling of the great volume of traffic over these drawbridges naturally causes congestion and creates many operating problems resulting from the delay to traffic by the opening of the drawbridges for the passage of vessels during the season of navigation. These troubles will be relieved by moving the freight via the Hudson River Connecting Railroad, avoiding Albany and crossing the Hudson River on a high-level fixed bridge instead of the drawbridge.

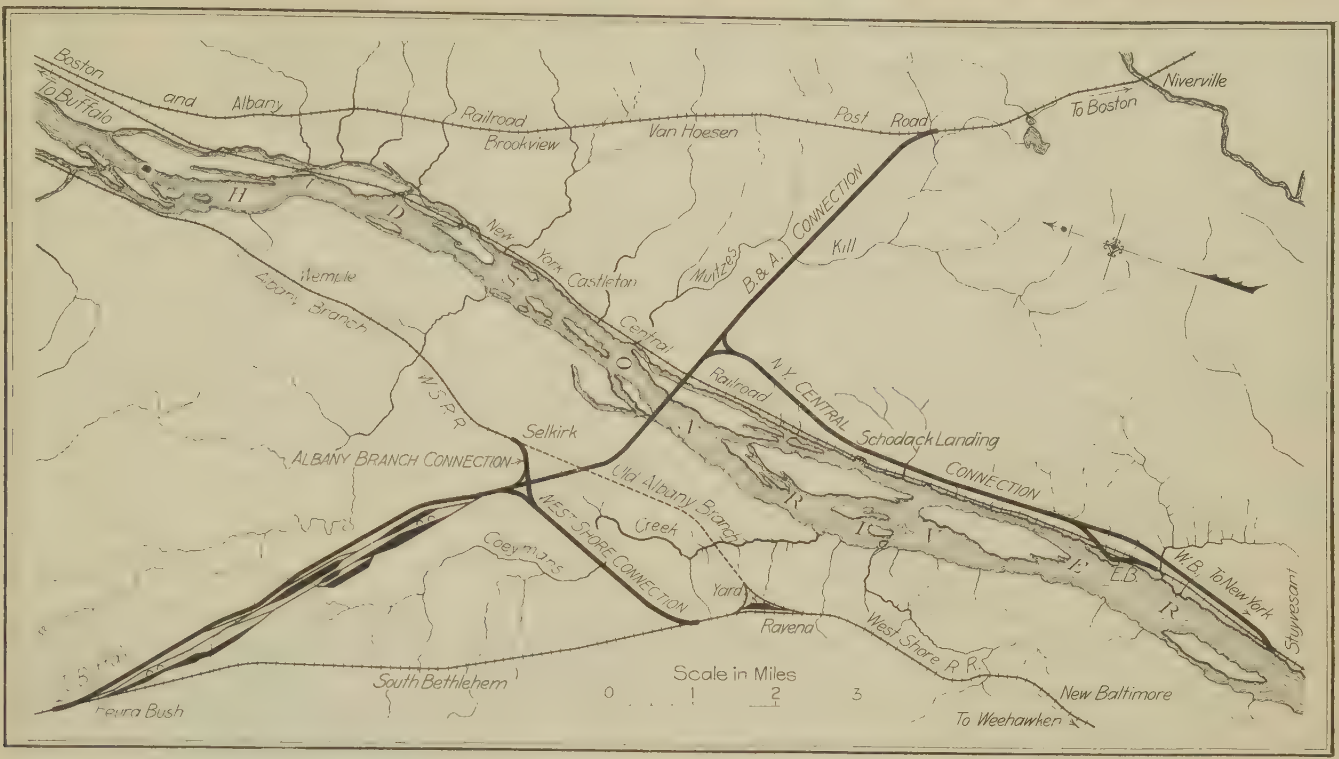
West Shore Railroad as an Auxiliary

The West Shore Railroad was built in the '80s as a parallel competitor of the New York Central, following the west bank of the Hudson River and the south bank of the Mohawk River. It avoids the sharp ascent at Albany by beginning the climb well down the Hudson River and passing over the brow of the hill 8 miles southwest of Albany. It then runs around Schenectady, avoiding the heavy eastbound ascending grade there. A branch of the West Shore runs from Ravena, where there is a division yard, to Albany.

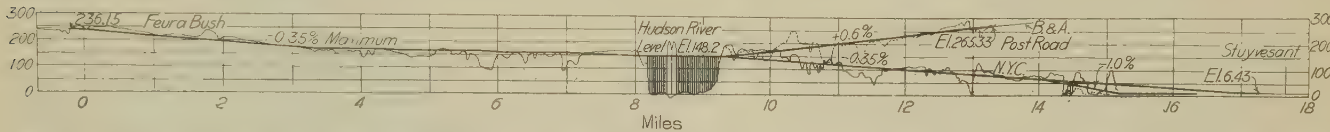


RELATION OF PROPOSED CONNECTION TO RAILROAD MAP OF ALBANY AND VICINITY

The New York Central has long had control of the West Shore, using it for the movement of considerable freight, which is thereby kept out of the way of the New York Central main line's heavy passenger traffic. The grades of the West Shore between Buffalo and



PROPOSED CONNECTION WILL UTILIZE WEST SHORE TO REDUCE GRADES AND AVOID CONDITIONS AT ALBANY



PROFILES OF NEW YORK CENTRAL AND BOSTON & ALBANY CONNECTIONS WILL CONFORM TO RULING GRADES OF THOSE STEMS

South Schenectady have been reduced to expedite the handling of this freight. A great part of the New York Central's eastbound through freight, for instance, is moved via the West Shore from Buffalo to South Schenectady, there crossing over to Carman on the main line of the New York Central, thence via the West Albany yard and the Albany drawbridge.

There are other crossings connecting the New York Central and the West Shore at various points between South Schenectady and Buffalo, providing flexible operation of the two systems. There being no connection east of South Schenectady and Carman, however, it is necessary to move all freight between the west and New York and Boston through the West Albany yard and grade and the congested drawbridge. New York freight can, of course, continue down the West Shore to the Weehawken terminal opposite New York, but this necessitates ferrying across the North River. The handling of freight via the Boston & Albany is further hampered by the heavy grades between Albany and Chatham. These difficulties will also be minimized by the proposed high-level connection and the diversion of traffic around Albany.

FIRST STUDIES MADE IN 1902

As early as 1902 studies were made with a view to overcoming some of the disadvantages at Albany. The first studies contemplated a high-level bridge over the Hudson at that point, the line swinging around to the Boston & Albany first, then continuing down to the New York Central south of Rensselaer. This plant, however, would not have solved the problem of the West Albany yard. Later the possibilities of a mammoth classification yard on the plateau traversed by the West Shore south of Albany were perceived. Several possible sites for a high-level bridge were investigated and numerous studies were made. The final choice is shown by the large plan.

DETAILS NOT YET WORKED OUT

Most of the details are yet to be worked out. As now planned, the connection will leave the Boston & Albany at Post Road, 1½ miles north of Niverville and about 4½ miles east of the Hudson. It will cross the river practically at right angles. Except for a slight swing just east of the New York Central junction, the line will be straight from the Boston & Albany across the river. The westbound New York Central connection will begin the ascent from the main line at Stuyvesant, 8 miles below the high bridge; to avoid a grade junction, the eastbound connection will cross over the main line and join it 1½ miles north of Stuyvesant. West of the Hudson River bridge the line will pass over the relocated Albany branch of the West Shore, the present Albany branch being abandoned between Selkirk and Ravena. Beyond this the proposed freight yard will extend 5 miles to the junction with the main line of the West Shore at Feura Bush.

Profiles are shown of the various lines. The Boston & Albany connection will leave that road at El. 265.33 and descend on practically a uniform 0.6-per cent grade to the level of the bridge, El. 148.2. The westbound New York Central connection will have a uniform ascending grade of 0.35 per cent, compensated. The lower end of the eastbound connection will be on a 1-per cent grade. West of the bridge the ground slopes gently upward and the profile can easily be kept to the ruling grade of 0.35 per cent.

A YARD LARGER THAN GARDENVILLE

Studies are being made for a yard at Feura Bush that will rival the one being built by the company at Gardenville, near Buffalo. Nothing is determined as yet, but it is probable that the yard will have five humps and that its capacity will be 23,000 cars. The layout can be made to fit the ground closely.

The details of the bridge depend on the decision of the War Department in the matter of spans, but it must clear high water by 135 ft. The plan submitted by the railroad contemplates a 600-ft. span over the government channel and an auxiliary 405-ft. span immediately to the east thereof. There will probably be a long viaduct approach at the east end and a shorter one at the west, the probable total length of the bridge being about 5100 ft.

On the main connections the sharpest curve will be 2 deg. 30 min. On the less important connections there will be one or two 6-deg. curves. There will be no highway grade crossings. Probably three highways will have to be carried over the Feura Bush yard. Various other highways will be carried over or under.

Considering the magnitude of the project, the amount of grading will be small, as the various lines have been so located as to follow the ground closely at most points. The largest cut will be at the junction of the New York Central and Boston & Albany connections, where about 800,000 cu. yd. will have to be taken out, all of which can be used to advantage in embankment.

SAVING IN DISTANCE

With the completion of the improvement the Feura Bush yard will be the division point for New York Central, West Shore and Boston & Albany freight. Besides avoiding the Albany drawbridge, the West Albany yard and the grade difficulties, the proposed connection will save the New York Central 4.5 miles and the Boston & Albany 2.7 miles in distance.

The plans to date have been developed under the direction of G. W. Kittredge, chief engineer, and J. W. Pfau, engineer of construction. B. C. Martin has within the last few months been appointed district engineer to take immediate charge of the construction. H. T. Welty, engineer of structures, will have charge of the design of the Hudson River bridge, while G. P. Stowitts, designing engineer, will direct the design of the Feura Bush yard.

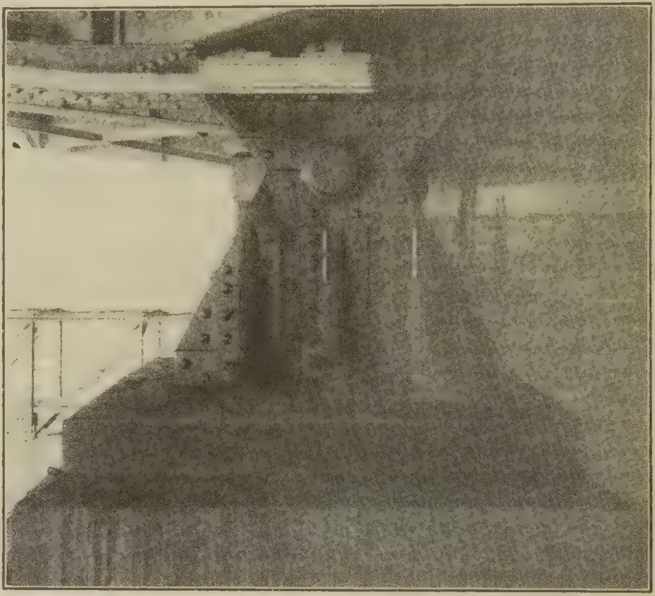
Massachusetts Road Expenses Increase

Expenditures for road improvements increased 205 per cent in Massachusetts in 1914 over expenditures ten years ago, according to road statistics made public recently by the U. S. Department of Agriculture. The State spent more than $6,000,000, giving her a percentage of 45.53 surfaced roads. Approximate expenditures for the other New England States were: Connecticut, $3,640,000; Maine, $2,642,000; New Hampshire, $1,590,000; Vermont, $1,024,000, and Rhode Island, $446,500.

Waterproof Box Built Around Expansion Rollers

Riverside Drive Viaduct Repainted and Repaired—White Lead and Tallow Applied to Rollers After Cleaning

THE PRELIMINARY inspection of a viaduct, about 40 ft. high, which carries Riverside Drive in New York City over the New York Central tracks between West 153d Street and West 155th Street, revealed that the paint on the steelwork had deteriorated to such an extent that approximately 5 per cent of the metallic area exhibited deep pits and scales; also the expansion roller nests, which were unprotected from the elements, had become badly rusted. Under an appropriation from the city for repainting and repairs the entire structure was chipped clean, painted and specially designed housings were provided for each of the thirty-three roller expansion bearings, to keep out the water and protect from dirt and rust. The details of this housing are here illustrated.

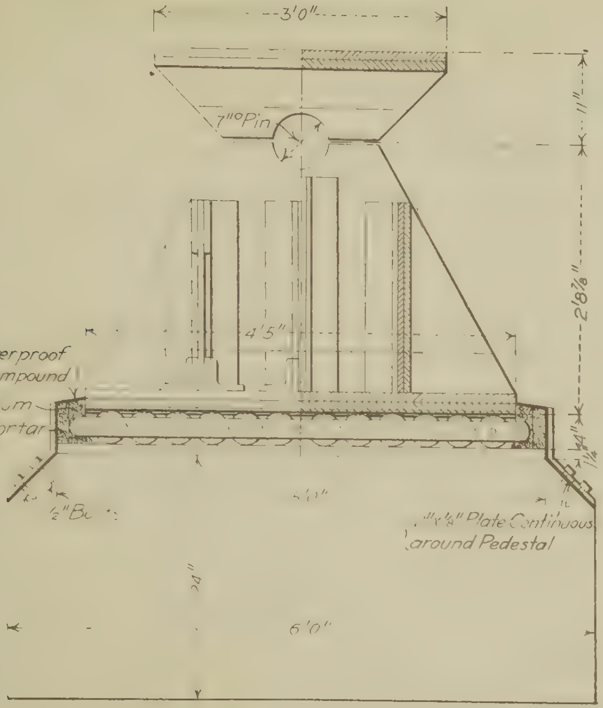


ROLLER NESTS ARE OILED, SEALED AND WATERPROOFED

The steel cantilever structure, erected in 1908, is 680 ft. long and contains thirty-three plate-girder floorbeams, 10 ft. deep, with a maximum length of 97 ft. for twenty-five girders and varying lengths for the eight girders at the curving southerly end, as shown in one of the photographs. The overhang of the main girders is 49 ft. and the anchor span is 46 ft. 6 in., resulting in possible uplift at the inner ends, for which anchorage is provided.

The expansion detail was designed with 7-in. pin bearings in built-up shoes with sole plates about 4 ft. square resting upon a roller nest of twelve 4-in. rollers. The base plates, 5 ft. square, rest directly upon granite pedestals on the western of the two parallel concrete and granite walls of the substructure.

The computed horizontal movement of the roller for a variation of 100 deg. Fahr. is 3/8 in. It was considered necessary that these rollers should be protected from rust and properly lubricated in order to



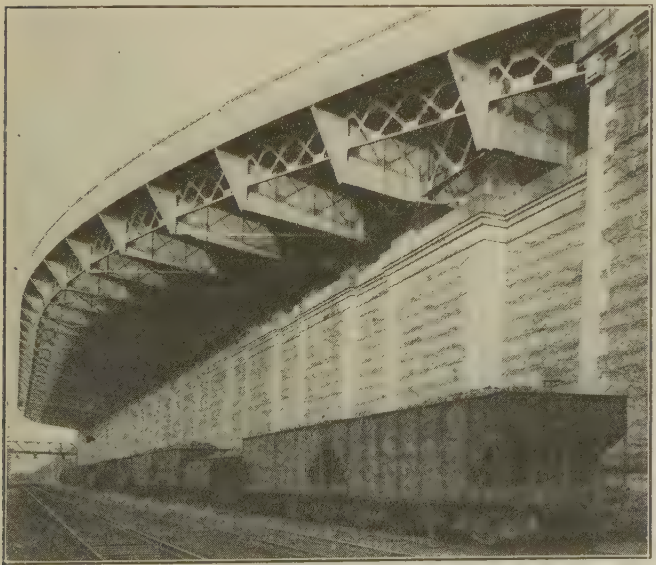
DETAILS OF METHOD USED TO SEAL ROLLER NESTS

prevent the development of temperature stresses. This was accomplished as follows:

HOUSING THE ROLLER NESTS

All the side bars were removed from the roller nests and the rollers cleaned of rust and scale by scouring with steel wool and the use of an air blast. An application of white lead and tallow to all the rollers and bed plates followed. As indicated on the drawing, 12x⅛-in. steel plates 5 ft. 2 in. long were then bent longitudinally to allow one leg to be bolted to the bevel face of the granite pedestal by ½-in. bolts, while the other leg is vertical. When spliced at the corners, these plates formed a square metal box open at the top. Before bolting them to the masonry, they were heated and molten waterproof cement was applied between them and the granite and to the corner joints.

The inside of this box was then lined with Portland-cement mortar up to within 1½ in. of the rollers, the space was packed with oakum and the whole sealed on the top with waterproof elastic cement applied in a molten state. In this way a complete housing is formed around the rollers which permits of free movement and yet excludes water, dust, débris, etc. It also prevents the corrosion from water of condensation because it excludes circulating atmospheric air, and at the same time, by the removal of a small portion of the oakum, will permit ready access for examination or lubrication.



EXPANSION ENDS OF CANTILEVER GIRDERS SUPPORTING RIVERSIDE DRIVE

In fastening the ⅛-in. plates to the granite pedestals it was noted that several of the roller bed plates had been originally set out of line, and it was necessary to trim them with the oxyacetylene burner in order to place the housing symmetrically. It was also necessary to drill the granite for fastening the 1¼-in. bed plates, as no bolts had been placed in the anchor holes of the bed plates.

The work was done, at the request of the park commissioner, under the supervision of the Department of Plant and Structures of New York City, of which F. J. H. Kracke is commissioner; E. A. Byrne, acting chief engineer; and A. LaForge, resident engineer.

Large Vessels Built of Reinforced Concrete in Norway

Lighters Resembling Huge Barges Are Being Constructed of Concrete on Steel Ribs—Slip Ready for 4000-Ton Craft

A RECENT letter from the American consul-general at Christiania describes the application of reinforced concrete at a plant in Moss, Norway, to the construction of vessels of relatively large displacement —up to 3000 tons. The following quotations from this letter indicate the extent of the new development in the concrete field in Norway:

"The inventor of this new style of vessel is said to be M. Nicolai Fougner, an engineer, who claims to be able to construct a ship of any size demanded. He is now building a lighter for a mining company at Sydvaranger for the oversea export of iron ore and the import of coal. The vessel, having a displacement of 3000 tons, is to be ready before the end of the current year. It is stated that these concrete ships can be sailed or engined like other vessels, and experts consider that a new epoch in shipbuilding has arrived.

"The ship, which arrived in Christiania last month, resembles a large barge, and is constructed entirely of concrete with the exception of the ribs, which are of steel. This new method of constructing ships has attracted much attention. The Swedish Minister of Marine, M. Brostrom, one of Sweden's largest shipowners, immediately ordered a lighter of some thousand tons displacement, and he was present when the craft was launched at Moss. He was accompanied by four experts, all of whom expressed much satisfaction at the result.

"Two other lighters are now on the stocks, and a large slip for a 4000-ton craft is nearly completed. More than 200 men are now working in the new yards, and five lighters have been contracted for in addition to the one completed and the two on the slips."

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Largest Floating Drydock

Sir: In your issue of Jan. 20, page 123, you print a photograph and give a description of a floating drydock. You do not say so unqualifiedly, but the inference is that the drydock described is the largest in existence.

When giving this description we think the writer must have either overlooked or not known of the floating drydock Connaught located at Montreal. This floating drydock is, I believe, owned by Canadian Vickers, Ltd., and if my recollection serves me correctly it is 600 ft. long and has a maximum lifting capacity of 25,000 tons.

If the figures I mention are correct, the floating drydock Connaught is twice as large as the one described in your issue of Jan. 20.

M. Beatty & Sons, Ltd.,
Montreal. G. W. Day, Sales Manager.

Water the Chief Factor in Making Concrete

Sir: The article by Mr. Johnson, on page 790 of the issue of Dec. 30, 1916, goes straight to the root of all laitance trouble and merits careful consideration by all engineers and contractors engaged on concrete work. One engineer has said that if water cost $5 a barrel we would get much better concrete.

Any laitance formed on concrete which will just flow slowly through chutes with a slope of 3 to 1 in a constant stream should be removed readily with wire brushes a few hours after setting. At the start it will require an engineer and two inspectors, one at the mixer and one in the forms, to obtain this result, but it has been the writer's experience that once the contractor becomes accustomed to handling this "plastic" concrete he will be perfectly satisfied, as it is surprisingly mobile in the forms and flows a considerable distance without shoveling and with absolutely no segregation. At the top of a 10-ft. lift the workmen will stand only ankle-deep and no water will show on top.

The chutes furnished by any of the leading manufacturers will take care of the output of a ¾-yard mixer running 45 batches per hour. The main factor in the operation of a chuting system is the operator at the tower hopper. If the concrete is fed in a steady stream without a break between batches and there are no flat spots in the line of chutes no trouble will be experienced with a plastic concrete on 3 to 1 slopes. A batch of mortar should always be sent through the chutes at the beginning of a run to act as a lubricant.

John W. Ryckman,
Toronto, Canada. Department of Works.

Sir: I have carefully read the article on page 790 of the issue of Dec. 30, 1916, by Nathan C. Johnson, on "Water the Chief Factor in the Making of Good Concrete," and have come to the conclusion that Mr. Johnson has missed both the reason and the remedy in dealing with the subject of laitance. That laitance or cement cream exists and that it is harmful if allowed to remain in place in concrete masonry cannot be denied, but it is a far cry from the admission of these facts to acquiescence in a method of procedure that would treat this laitance as a useless byproduct that can with impunity be wasted.

Touching first on Mr. Johnson's last recommendation, I fail to see how this could possibly be put into practice. To allow the top materials to flow out of the forms and be wasted entails more difficulties than appear at first reading. In the first place, concrete that is not very fluid will not flow in this manner—the surface would have to be scraped or swept, which could scarcely be done inside of partly filled forms. Even for a very wet, liquid concrete, once settled in the forms, the surface material would not freely flow off. The laitance is often only a small fraction of an inch in depth, usually just a film. Would several inches of concrete be wasted just to skim off this little cream? Such waste would be intolerable.

It is true that under some conditions a thick layer of this laitance gathers. To waste this would be an economic blunder. If this slime or laitance were a waste byproduct like the froth on certain glasses of liquid refreshment, practical and economic means would doubtless be found of getting rid of it, and it could be wasted with impunity. But this material is the real cement itself—the only part of Portland cement that has any real cementing value. Hundreds of thousands of dollars are spent to produce this by processes that turn out finely ground cement. If this so-called slime could all be extracted from cement, there would be nothing left but a finely broken-up, inert clinker of no value whatever as a cementing material.

Mr. Johnson advocates the wasting of this valuable material in a paper that does not even hint at the one true method of preventing its segregation and conserving it for the purpose of performing a function that no other material can perform. The method to which I refer is thorough mixing. I fail to see that excess water is the bugbear that Mr. Johnson makes it out to be, and I think it would be a step backward even to approach the old method of making mealy concrete and tamping it in place. The concrete specified 15 or 20 years ago was so porous that water would flow readily through 30 ft. of it. Wet, poured concrete will hold back water under pressure in thicknesses of an inch or two.

Mr. Johnson makes much of the supposed fact that for every $100,000 worth of concrete $17,000 to $40,000 is paid for holes. What of it? If this were true, it would mean a saving. Concrete is paid for in materials and the more space these materials occupy the less the concrete will cost. If the waterproof qualities and the strength are not affected by minute pores, these pores cannot be said to be harmful. One is not cheated when he buys a sponge, even though the great portion of his purchase is air. Pores do not mean permeability of necessity. Cork is an example of this. But mealy concrete is both porous and permeable. It is like the sponge. Good wet-flowed concrete is somewhat porous, but it seems to resemble cork in that the pores do not form continuous free passages for water.

Increase in the amount of water in the concrete mix has been taken advantage of by unscrupulous and ignorant contractors by reducing the time of mixing, and this is the crux of the matter. A wet combination may appear to be well mixed when in fact it has been turned over only once or twice, whereas a dry combination does not so readily deceive the eye. It is common to see a batch mixer turned for only 30 seconds for each batch. The Joint Committee, in its latest report, wisely requires that the minimum time of mixing be 1½ minutes. If the bulk of concrete work were mixed three times as long as it is customary to mix it, vastly better concrete would be turned out.

A paper by the writer published in the Engineering Record Oct. 16, 1909, page 435, entitled "The Nature of Portland Cement," demonstrated that the setting of Portland cement is merely the hardening of a colloid, and what crystallization takes place is incidental and of no consequence. It was shown that this so-called slime, this cream of cement, this laitance, is in reality the colloid, the active part of the cement. The rest is merely inert, broken-up clinker. If the colloid is lost, the cement is useless and the concrete will be rotten. My paper pointed out that thorough mixing is the remedy to avoid this loss.

Another problem mentioned by Mr. Johnson is the bonding of new concrete to old. The solution of this problem is often up to some one who had nothing to do with the placing of the old concrete and who could not go back and adopt Mr. Johnson's wasting method. Thorough mixing of the newly laid concrete is the best possible precaution to insure adhesion to the old surface, and picking or scraping of the latter is usually a necessity.

In the case of laying a finish coat over a base some time after the base has been poured, the best time to remove the laitance is after the base has had some set; that is, half a day or so. It is well known that concrete very soon settles into place and loses its tendency to flow, hence after the half hour recommended by Mr. Johnson the top material would not flow off. After the concrete has had time to set, the laitance may be removed by flushing or sweeping. This would expose the top stones without disturbing the mass underneath.

The problem of dusting floors is also mentioned by Mr. Johnson. Here again thorough mixing is the remedy, coupled with a minimum of troweling. Troweling is the cause of much of the dusting of floors. This draws the laitance to the surface. This material has no strength or wearing quality in itself, and being on the surface has nothing to hold together—its sole function. Dusting is a natural consequence. The beautiful troweling of sidewalk pavements, to make them look good when the owner "comes across," is what makes them pit so badly a few weeks later. Sidewalks and floors should only be troweled enough to flatten the surface.

Mr. Johnson's paper would indicate that laitance on an ordinary job is several inches thick. Otherwise how could it flow off from a horizontal surface? Also what is the significance of his sentence, "How puerile appears the dainty surface picking of massive deposits of concrete usually required, when the usual depth of laitance is taken into consideration." It is true that the laitance may be several inches thick when a large quantity of concrete is deposited through water. Also it may be a good fraction of an inch thick on jobs where a large quantity of free water is slopped in with the concrete to obscure poor mixing and to make the stuff flow through an almost horizontal chute. The latter practice is reprehensible, but should not be confused with the employment of good, wet, freely flowing, properly mixed concrete.

It is a pity that the failure of the Austin dam should be blamed on bad concrete. This only obscures the fact that the design was bad. No stone concrete that was ever made would have been stable against the water pressure exerted on this dam. The pressures on the upstream face and the base of this dam, forces that could have been calculated and should have been anticipated before it was built, were enough to account fully for the failure. Why look farther?

Pittsburgh. EDWARD GODFREY.

[The foregoing letter was submitted to Mr. Johnson, and his reply follows.]

SIR: Mr. Godfrey seems to labor under a misunderstanding as to the behavior and functioning of cement. If, as he says, "this material (laitance) is the real cement itself—the only part of Portland cement that has any real cementing value," and "this so-called slime or cream of cement, this laitance, is in reality the colloid, the active part of cement," and "the setting of Portland cement is merely the hardening of a colloid and what crystallization takes place is incidental and of no consequence," not only must all the rest of cement in concrete be what he terms "inert clinker of no value whatever as a cementing material" with any set of the mass inexplainable, let alone its well-known increase of strength with age in most instances, but also this quintessence of cement at the top should have most remarkable properties, all of which is exactly at variance with fact.

Mr. Godfrey's defense of porous concrete by drawing a parallel between it and sponges as offering, in each case, good value to the purchaser is neither fortunate nor true, because of their dissimilar uses. Nor can so ready a remedy as mixing 1½ minutes, as recommended by the Joint Committee in its latest report, bring about entire relief from present suffering. It would be interesting as a sidelight on the efficacy of this suggested remedy to know what provisions the Joint Committee made for the enforcement of this recommendation and with what result, and also how many members of the Joint Committee itself are requiring in their specifications and in their superintendence that the quality of their own work shall be assured by a rigid adherence to this rule.

The problem of bonding new concrete to old and the complex problem of producing dustless concrete floors require more than a slight prolongation of splashing after the manner of purling waves upon a sparkling shore. Nor is laitance merely a scum removable by brooms or by flushing, either of these exposing the top stones without disturbing the mass underneath. Surely there is some inconsistency, for if laitance is colloid and if this colloid contains the only valuable principles of Portland cement, there should be no necessity for removing it, or else, if through some unexpected circumstance this essence fails to retain the magic necessary for supreme usefulness, so that it is necessary to remove it, there must be some mistake either as to the method of removal proposed by Mr. Godfrey or else as to its thoroughness, inasmuch as it is difficult to determine (as anyone who has studied physical chemistry can appreciate) the depth to which solutions will merge one into the other.

Mr. Godfrey also wrongly assumes that which was specifically warned against in my article—namely, that an argument against excess water should be construed as an argument for dry concretes. Furthermore, resurrecting the Austin dam from its limbo is not necessarily to be called "a pity." Mr. Godfrey thinks much upon design and is unquestionably qualified to pass judgment upon this feature. But even granting the face value of what he says in regard to the Austin dam design, Mr. Godfrey should be the first to recognize that the best design can be negatived by poor execution. Reason enough is provided in this fact alone for emphasizing the possible responsibility of execution for the Austin dam failure.

These comments on Mr. Godfrey's letter are almost unnecessary, as they are self-evident to those familiar with the true inwardness of concrete. Mr. Godfrey's letter, however, is potent for general misunderstanding. The making of concrete is essentially an exact science. Knowledge with regard to it is not general, but must become general if concrete is to prove worthy of its prestige. The haphazard method and the wrong practice so often openly sanctioned or permitted must give way to improved procedures, else there will be in the future less need for concrete design than is enjoyed at the present time. Progress and exact knowledge, rather than standpatism, are urgent and immediate necessities.

NATHAN C. JOHNSON,
Consulting Concrete Engineer.
New York.

Making a Success of Road Contracting

SIR: The article in your issue of Jan. 6, page 7, is exactly correct in that the execution of a road contract is more difficult than almost any other form of a contract. However, the exact reverse idea is prevalent with the general public. One of the most common causes of trouble on the job for both the contractor and the engineer is the inability of the general public to realize the difficult problems that arise in highway construction and maintenance. Nearly every man, whether he is a merchant, farmer, doctor or lawyer, feels that he is a natural-born road builder, and that he can solve any road problem, while in fact he has little realization of the true complexity of these problems. Such is the class of people that are most liberal with their adverse criticisms. I wish that every such person could read and realize the truth and force of the first paragraph of this article.

In the items set out under the heading of cost data, I would make the change in numbers two and three as follows:

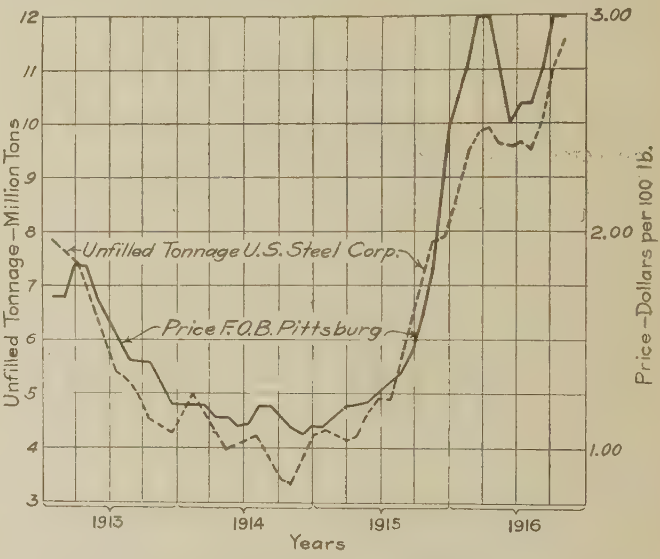
2. Be sure that the necessary quantity of the quality of materials specified is available. (a) Protect yourself against the prices of all such materials.
3. Figure everything accurately. Don't guess. Check your computations by different methods of calculation.

The change in item two seems to me to bring out a vital point omitted, while the change in number three simply adds more stress to a point brought out in the first three words under the heading of "Cost Data."

ARTHUR W. THOMSON,
County Surveyor, Marshall County, Indiana.
Plymouth.

Steel Prices Reflect Demand

SIR: The article on page 9 of the Engineering Record of Jan. 6 on the prices of construction materials is of interest to the writer, who has just completed an investigation of steel prices for the information of the buying staff of the company with which he is connected. Two curves plotted [reproduced herewith] indicate that steel prices show a suspicious tendency to follow closely the old law of supply and demand. The dashed line was made by plotting the monthly balance of unfilled orders published by the United States Steel Corporation, which is taken as a fair barometer of the demand for steel. The solid line is a curve showing the prices per 100 lb. quoted on corresponding dates for steel bars, f.o.b. Pittsburgh.



PRICE OF BARS FLUCTUATES WITH STEEL CORPORATION'S UNFILLED TONNAGE

DAN PATCH,
Abertbaw Construction Company.
Boston.

Motor-Truck Legislation

SIR: The subject of regulation of motor trucks is not only interesting but is of vital importance to all the more thickly settled communities, and also to the "North Shore." We are all fast realizing that motor trucks must be carefully regulated in the very near future. Even now they are a problem with which engineers are at a loss to cope.

Personally I believe that not only the weights but also the widths should be limited, and that they should be required to travel on the right side of the road owing to the noise some of them create, which makes it impossible to hear the horn of a vehicle attempting to pass. There should also be drastic regulations as to their use of roads, which at certain times of the year are incapable of supporting that kind of traffic without unreasonable damage.

Limitation of wheel widths should be written into our road laws, not only in regard to motor trucks but also in reference to narrow-wheeled horse vehicles. I do not think that the question need wait for five years to be of importance to us, and I am glad that you are bringing the subject to the attention of engineers and the public.

CHARLES E. RUSSELL,
County Superintendent of Highways.
Waukegan, Lake County, Illinois.

How Soon Should the Surface of Concrete Roads Be Finished?

SIR: In your issue of Jan. 13, page 75, is a letter from Edward N. Hines, the justly famous concrete road man of Detroit, seeking a discussion of the question as to the proper time for finishing the surface of concrete pavement. As Sioux City has achieved something of a reputation for its pavements, and as our method of finishing resembles his just as black resembles white, I am moved to write to you.

I would explain here, however, that my definition of "finishing" is not commensurate with the idea of simply putting the surface in shape to receive the traffic. It will be seen that the difference between our methods begins right in the beginning, with the definition of the term.

I do not agree with Mr. Hines that the proper proportioning of the mixture has been definitely settled, if he means by that that all are agreed on the proportions he uses, 1 : 1½ : 3. For one, I think that is too large a proportion of cement. It not only is not necessary, but may be positively harmful.

I think the value of an extremely rich mixture, in its relation to the wearing quality of a pavement, is greatly overestimated. Resistance to abrasion and to cracking is only another definition for "bond," and can be imparted more effectively in terms of labor than of cement. We use proportions of 1 : 2½ : 4, and our results compare favorably with those attained elsewhere, but we make up for leanness in cement by the addition of "elbow grease."

The proper quantity of water is another matter Mr. Hines assumes to be satisfactorily settled, but about which there still seems to be considerable misunderstanding. Water in concrete performs a dual service. One part is chemical and the other mechanical. The cement must be hydrated and the mass lubricated. A much larger proportion of water is required for the latter than for the former. It occurs to me that frequently when we think we are thinking of water for hydration we really have in mind water for lubrication, and the result is confusion as to just what is meant by the term "excess water." The proportion of water properly to lubricate the mass is very much in excess of the quantity required to hydrate the cement, so that from that point of view a concrete no wetter than Mr. Hines recommends has an "excess of water." Note the fact that concrete used for all molded work—building blocks or drain tile, for instance—is dry and crumbly, and yet the cement is hydrated.

It is conservatively estimated that in an ordinarily wet concrete about 7 per cent of the mass is uncombined or "free" water. What eventually becomes of this water? Under ordinary methods of finishing concrete road surfaces, part is absorbed by the earth foundation and the remainder evaporates. The result is a slab with voids to the extent of the space occupied by this water; that is, about 7 per cent.

This water having been distributed evenly through the mass, the particles of fine aggregate are not evenly supported by the cementing agent, and are therefore easily abraded. Hence, a pavement that "dusts." Finishing a pavement where an excessively rich mixture is used soon after the concrete has been placed, and while it still retains this excess water, results in the formation of a thin scale, composed largely of laitance, or what concrete workmen call "cement cream," which peels under traffic. This accounts for the scaling and dusting noted by Mr. Hines.

Mr. Hines refers to the laying of concrete floors, and suggests the application of the method cited to the laying of pavement. In the laying of concrete floors, if the base is laid fairly dry, and tamped, and a comparatively thin wearing course applied immediately, the base will absorb the excess water in the top mortar, and finishing with the steel trowel can follow immediately. The water having been disposed of, and the mortar stiffened thereby (we accomplish this same result for our entire pavement slab by the application of a dry mixture of cement and sand), the troweling closes up the spaces it formerly occupied, resulting in a dense, close-grained wearing surface that does not "dust."

These methods, however, are not applicable to the laying of pavement. On the contrary, our method of laying concrete pavement is applicable to the laying of concrete floors, and I have in mind a certain garage floor, now about three years old, where the concrete laid in the forenoon was finished in the afternoon. Chains on the heaviest automobiles do no more to this floor than to leave a white mark. It is needless to say there is no sign of "dusting."

As to the length of time that should intervene between the placing of the concrete and the final finishing, there are a number of factors that enter into this determination. First, I would say that it is not the lapse of time but the condition of the concrete that should determine. It cannot be properly finished as long as there is water in or near the surface. The mass must receive treatment that will compact it, and this cannot be done while it contains water, because water is non-compressible. This water must be either absorbed by the earth foundation, driven out, or evaporated. After the water is disposed of, the pores must be closed, and the mass be made dense and impervious, if the desired resistance to abrasion or "bond" is to be secured. Mr. Hines lays his pavement under two very favorable conditions. One is his sandy soil, which, notwithstanding he wets it, absorbs his excess water and permits earlier finishing, and the other is the humidity of his atmosphere, due to the proximity of large bodies of water. This prevents a too rapid dryout. The first of these advantages he fails to appreciate though, and takes no advantage of it. If he would use a roller, as is done in Macon, Ga., or some other method of compacting his concrete, he would get a denser pavement, and one less liable to crack or "dust." On the other hand, if he had our hot, dry winds to contend with, his surface would dry out before it had time to set, and would be filled with shrinkage cracks.

I hardly think the fact that in ordinary concrete construction mixed concrete is rejected after 30 minutes is sufficient ground for assuming that concrete pavement will necessarily be injured by continuous floating for a longer period. It is not so much that the floating disturbs the chemical process of setting as that it prevents the mechanical hardening due to loss of water.

About 1905 this office made a series of tests to determine the effect on concrete mortar of continuous mixing. The mortar was mixed continuously for nine hours, additional water being added from time to time. Every three minutes portions were removed and made into briquettes. The breaking of these test pieces showed an increase in strength up to about the third hour, and then a gradual decrease to a loss of about 10 per cent at the end of the ninth hour. The results of these tests were reported in the *Engineering News* at the time.

By continuous floating, the cement is kept moist and permitted to hydrate, the water is eliminated, and the concrete compacted and toughened. When setting is sufficiently advanced to render the mortar pasty and adhesive, we discontinue the floating.

Most of our pavement is finished about two hours after placing, much of it not till four hours after, and in the fall, some placed late in the afternoon does not receive the final floating until the following forenoon.

What are the results? We have a 16-ft. highway pavement in its second year that, on careful examination in driving over it, disclosed not more than one cracked section to the mile. We have streets a half mile long and 30 ft. wide and in their fourth year without a single cracked section. We have others of the same width and older with not 1 per cent of cracked sections.

T. H. JOHNSON,
City Engineer.
Sioux City, Iowa.

SIR: The question raised by E. N. Hines, chairman of the Wayne County (Mich.) Board of Road Commissioners, as to how soon concrete roads should be finished is a very important one and should receive more than a passing consideration.

The dusting of floors and the flaking of concrete road surfaces can in the main be attributed to the disturbance of the concrete at its most critical period of setting. Contractors perform work and engineers and architects draw specifications that are bound to cause dusting or flaking, as the case may be, if the specifications are followed to the letter. This is mainly due to the fact that the chemical actions of the setting and hardening of cement are not understood.

It is generally understood that the chemical action of the setting begins as soon as water is applied to the cement, and while this is true, until the process of crystallization is under way no harm will result from the disturbance of the mass. Le Chatelier definitely determined that the formation of crystals in setting cement follows certain laws, the first crystals formed being in the form of six-sided plates. From these plates crystal points extend as the chemical action proceeds, these points attaching themselves to other points or plates or to any other body with which they come in contact. Once these crystal points begin to form, any disturbance of the mass fractures the points, and once fractured they do not unite again, either with themselves or with other bodies in the mass.

No hard and fast rule can be laid down for the finishing of cement surfaces, as three physical conditions tend to either prolong or accelerate the process of crystallization, these features being (1) chemical composition of the cement, (2) fluidity of the mass, and (3) heat. The writer has made hundreds of tests and observations of concrete work during the last sixteen years, and has found that under ordinary conditions not more than twenty or twenty-five minutes should elapse from the time the concrete is placed until all work on the mass should cease.

Owing to the shrinkage of the concrete mass, it will probably be impossible to secure an absolutely smooth surface free from depressions, but it is much better to have a slightly uneven surface than one in which the crystals have been more or less broken up. It is easy enough to produce floors that will not dust and roads that do not flake, and there is nothing mysterious about the process. In finishing surfaces within twenty to twenty-five minutes after the concrete has been placed, it is often necessary in places to remove an excess of water by means of burlap or other absorbent material.

Mr. Hines, in the third paragraph from the last in his letter, says: "Mix your concrete dry by using the correct percentage of water." It has been thoroughly demonstrated that a "dry" mixture must of necessity be very much more porous than a wet mixture, inasmuch as the dry mixture when placed has an excess of voids which are filled with air, and which all the tamping and puddling that may be done will not eliminate, owing to the extreme elasticity of air. It might be possible in this way to get a surface that would not flake, but the quality and durability of the concrete would be seriously affected, especially in a latitude where there is a great deal of freezing and thawing. The disrupting power of frost is too well known to need comment.

There are a number of things that go to make up an ideal concrete road, and two of the most important features outside of the proper proportions of the mixture are: (1) that the concrete shall be mixed wet enough and to such a degree of plasticity as to make the mass as dense and as nearly impervious as possible and (2) that the mass shall not be disturbed under any circumstances after the formation of crystals has begun, even if the surface does not present an absolutely perfect contour.

J. EDWARD CASSIDY,
Chief Engineer, Foster Construction Company.
Newark, N. J.

Wants Timber Branded with Grades

SIR: Permit me to compliment you on the editorial in your issue of Dec. 30, 1916, page 787, on the revision of the grading rules of the Southern Pine Association for "select structural" grade.

I firmly believe that this change in the grading rules is a step in the right direction, and I am also convinced that the Southern Pine Association should go further and revise its rules by providing for the branding of timber, not only with the name of the manufacturer but also with the grade, in order to simplify inspection of timber by those not especially skilled in the determination of timber grades.

At present it is possible to secure Southern pine timber branded with the name of the manufacturer only, but such branding does not mean anything. It is somewhat surprising that the Southern Pine Association has not as yet officially adopted a rule for the branding of timber with the grade, in view of the numerous demands which have been made by the users of timber, including the National Retail Lumber Dealers' Association.

F. E. Davidson,
Consulting Engineer and Architect.
Chicago.

Form for Filing Records of Construction Conditions

Sir: Many valuable lessons are lost to the engineering profession by reason of the failure of the engineer to keep and preserve records of his experience. When no records are made, even the engineer in constant charge of the work sometimes finds his memory a very poor reference when he wants to study the methods and conditions that may have contributed to the success or failure of a certain piece of work. Sometimes valuable data are collected in the form of daily reports, memoranda or diaries, but usually these are pigeonholed after the work is completed, or filed away in unused files and lost in the mass of data seldom if ever referred to.

In the case of road building, how valuable it would be to the profession to-day, in studying some of our old and successful types of roads, if we knew in detail all the conditions under which the work was done—the materials used and their condition, the methods of construction, weather conditions, care used in protecting the work, and the many other little details that may have contributed to the success of the work.

Likewise, in the case of roads that have failed, these data are of no less value to the engineer interested in road problems. And inasmuch as the success or failure of a road may only be determined after many years of service, the construction records are of greater value as the years increase.

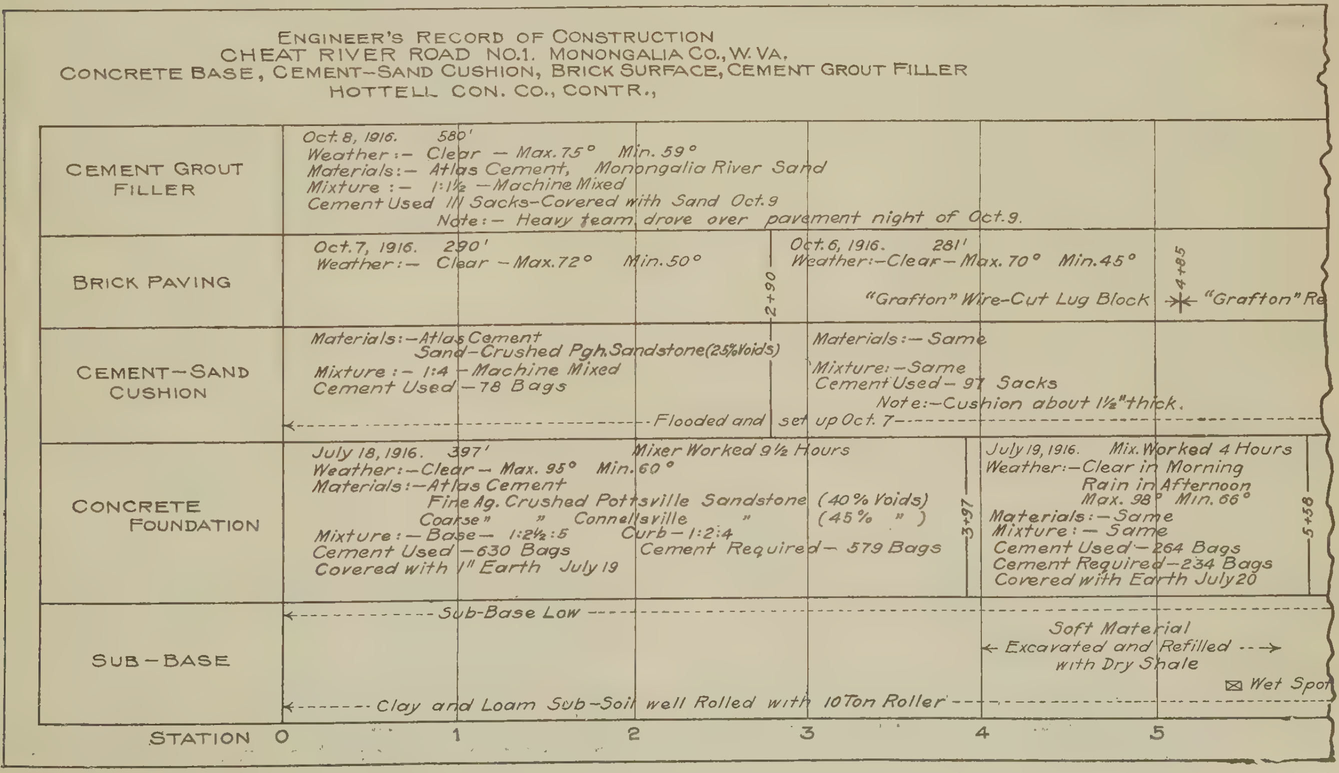
With a view to preserving the engineering data collected during the construction of the roads, and compiling them in a form that may be of service later to other engineers, as well as to the state and the county, the writer has adopted a graphic form as shown in the illustration. It may be prepared on profile or cross-section cloth or on plain tracing cloth. The form is self-explanatory.

The data shown have been collected from the inspector's daily reports, diaries, personal observations, and other notes and memoranda made by the engineer. The graphic form is made up during rainy days, or in the winter season, when construction work is at a standstill. Copies are filed in the office of the county engineer, the clerk of the county court, and with the state road bureau.

W. S. Downs,
Road Engineer, Monongalia County, West Virginia.
Morgantown.

Growth in Public-Road Revenues

Bulletin 390 of the U. S. Department of Agriculture reports that the total revenue applied to roads and bridges, and derived from appropriations, motor-vehicle registration and license fees has grown from $79,623,616 in 1904 to $240,263,784 in 1914, an increase of 201.75 per cent.



ENGINEER'S RECORD OF CONSTRUCTION
CHEAT RIVER ROAD NO.1. MONONGALIA CO., W. VA.
CONCRETE BASE, CEMENT–SAND CUSHION, BRICK SURFACE, CEMENT GROUT FILLER
HOTTELL CON. CO., CONTR.,

CEMENT GROUT FILLER
Oct. 8, 1916. 580'
Weather :– Clear – Max. 75° Min. 59°
Materials :– Atlas Cement, Monongalia River Sand
Mixture :– 1:1½ – Machine Mixed
Cement Used 111 Sacks–Covered with Sand Oct. 9
Note :– Heavy team drove over pavement night of Oct. 9.

BRICK PAVING
Oct. 7, 1916. 290'
Weather :– Clear – Max. 72° Min. 50°
2+90
Oct. 6, 1916. 281'
Weather :– Clear – Max. 70° Min. 45°
"Grafton" Wire-Cut Lug Block
4+85
"Grafton" Re

CEMENT–SAND CUSHION
Materials :– Atlas Cement
Sand – Crushed Pgh. Sandstone (25% Voids)
Mixture :– 1:4 – Machine Mixed
Cement Used – 78 Bags
Materials :– Same
Mixture :– Same
Cement Used – 97 Sacks
Note :– Cushion about 1½" thick.
Flooded and set up Oct. 7

CONCRETE FOUNDATION
July 18, 1916. 397'
Mixer Worked 9½ Hours
Weather :– Clear – Max. 95° Min. 60°
Materials :– Atlas Cement
Fine Ag. Crushed Pottsville Sandstone (40% Voids)
Coarse " " Connellsville " (45% ")
Mixture :– Base – 1:2½:5 Curb – 1:2:4
Cement Used – 630 Bags
Cement Required – 579 Bags
Covered with 1" Earth July 19
3+97
July 19, 1916. Mix. Worked 4 Hours
Weather :– Clear in Morning
Rain in Afternoon
Max. 98° Min. 66°
Materials :– Same
Mixture :– Same
Cement Used – 264 Bags
Cement Required – 234 Bags
Covered with Earth July 20
5+58

SUB–BASE
Sub-Base Low
Soft Material
Excavated and Refilled
with Dry Shale
⊠ Wet Spot
Clay and Loam Sub-Soil well Rolled with 10 Ton Roller

THIS FORM IF CAREFULLY KEPT CAN BE MADE TO SUPPLY MUCH VALUABLE INFORMATION

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Pile Driver Working Near Siding Unloads Tanks and Saves Demurrage

By GEORGE A. GIORLOFF
New York City

TWO SHIPMENTS of cylindrical steel tanks for use in constructing the plant of the White Tar Company near Kearny, N. J., came through with unexpected promptness and reached the job before arrangements had been made to unload them at the proper point for storage. In these days of high demurrage rates, it would have been expensive to hold the cars, and as several of the tanks weighed a ton or more, and all were loaded in gondola cars, it would have been slow and expensive to take them off by hand. An ordinary land pile driver, working within 200 ft. of the spot where it was desired to store the tanks, was moved over facing the side of the car and used to lift out the tanks and land them. It was necessary to build a short runway and turn the driver around to reach the side of the car. In unloading, the driver was run up to the car to raise each tank, and backed up about 20 ft. each time to land the tanks. The moving was done with the pile line, which was a wire rope, and the tanks were raised at the hammer line, which was of manila rope. The drop hammer was toggled at the bottom of the leads. The larger shipment, containing seven tanks, was unloaded with a total delay to the pile driving of 6 hours.

The plant mentioned is being constructed by T. L. MacBean.

SAM MARTIN was a mighty slick contractor—
he kept everything under his hat;

AND BILL BIRD, his rival in the same town,
couldn't keep a secret; everybody knew all
about the nifty tricks Bill used to turn;

AND A BIG PRIVATE JOB came up.
AND SAM WAS LOW, but Bill got it,
AND SAM KICKED to the engineer,

AND THE ENGINEER TOLD HIM: "We don't know
anything about your methods, but we know
that Bill has *brains*. Look at all the short-cuts
he gets up. Why, they tell about his stunts in
HINTS FOR THE CONTRACTOR."

Ever Run a Hoist? Own One? Does This Sound Familiar?

WHILE the master mechanic from Omaha or New Orleans may not be in need of advice from Brooklyn, everyone who has had to do with hoisting equipment will appreciate the following "hoist runneries" contributed by a reader who resides in the last-mentioned city, and who has evidently met with troubles of his own:

If the monkey wrench wasn't handy and you tightened the nut with a hammer and chisel, forgetfully leaving the chisel on top of the gear, what could you say when asked, "What broke that tooth?"

"Oh, it just fell out. Wasn't even hoisting a load; just turned the engine over and it dropped right out. They've got putty instead of iron in that gear."

If the brake was greasy or needed adjustment, and your load got away, and you threw in the dog to stop the drum, how could you answer the question, "What bent that shaft?"

"Oh, anybody can see that the shaft is too small, and look at the soft steel in it. It's awful. Why don't they just stick a match through the drum and be done with it?"

If your rope lead was too short or onesided and the line kept crossing and sawed the strands through; if you forgot to break her in time and the slack rope got all tangled and kinked; if your lead sheaves were stationary from want of oil, what should you say when asked, "Why are you putting on a new rope again?"

"I never saw such a rotten line in my life! Don't believe they can make the steel nowadays that they used to. There is no strength to it at all. She strands when running the bare hook. Anyway, the barrel is too small for that sized line, and it's all a man can do to bend it around the drum."

If you left the oil and grease uncovered, and it got full of grit, and your bearings started to cut and heat, the brass bushings and washers sifting yellow spots in the muck on the floor, how could you reply to the question, "What! relining her again?"

"Sure. This is my steady job every Sunday. The chief buys the cheapest grade he can find. Nothing but acid. Probably gets a rakeoff. You might as well use water, for all the good it does. This hoister never knew it had any oil. Anyway, the bearings are too short; should be twice as long."

If you absentmindedly left your wrench on top of the guide, and busted the crosshead, twisted the connecting rod, bent the piston rod and broke the guide bar, smashing up one side of the engine generally, what should you say to the polite inquiry, "What caused the smash-up?"

"Smash-up nothing! She just laid down, that's all. Too small for the job. She just kept going until she died. If they only had made both sides alike, she'd probably have held together for a while yet, but she's through now."

If the boiler was too full, and foaming for want of cleaning, or if the feet and braces were so loose that she was shaking water into the steam pipes and you were running "hydraulic"; and if the drips were plugged or busted, and your cylinder or backhead cracked, how could you pass off the remark, "What's the trouble now?"

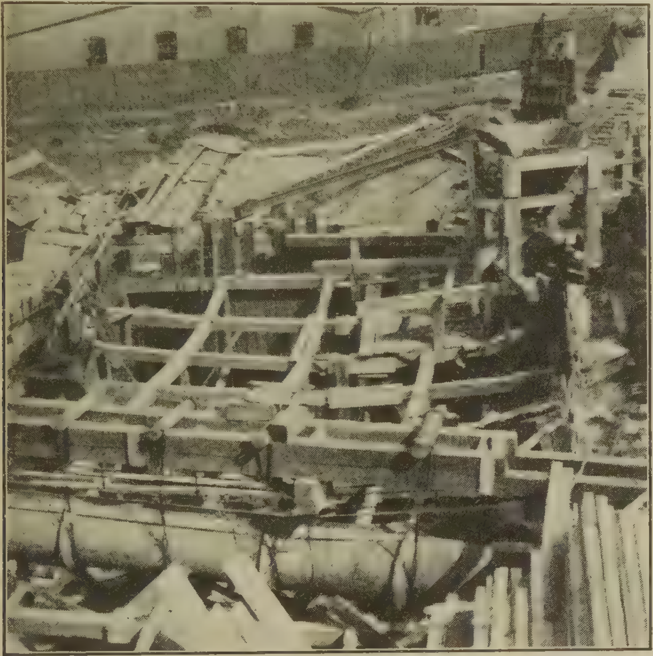
"This is no trouble—just everyday performance. One thing breaks, then another. It keeps me going fixing the blamed thing all the time. That cylinder is so full of blowholes, it's a wonder she didn't let go long ago."

If you didn't think the night would be so frosty, and neglected to drain her, you might reply to "What bent that valve rod, and how did that pipe burst?" with: "Oh, I've been expecting that for a long time. That rod was bent before I came on the job, anyway. It's too small, almost breaks her off screwing up the stuffing box. And that pipe—why, she just opened up in the seam, that's all. Bum weld, I guess. She's been leaky for some time."

Large Pipe Line Supported at Grade Over Coffer in Soft Soil

By H. W. STREULI
Schenectady, N. Y.

A FORTY-EIGHT-INCH cast-iron pipe with lead joints, which at times ran full of storm water, had to be supported rigidly on soft soil across a 42-ft. wide cofferdam during the construction of a Venturi meter chamber on the Passaic Valley sewer in New Jersey. Any deflection or settlement might have caused a rupture of the joints, with serious consequences.



LOAD WAS TRANSFERRED TO BRIDGE BEFORE SOIL UNDER PIPE WAS DISTURBED

The excavation at this point was 40 ft. deep and was made inside steel sheeting. The soil was running sand throughout, with the ground water level only a few feet beneath the natural surface. Support from the trench bracing being out of the question, a trussed support spanning the cofferdam was built as shown in the photograph.

As settlement outside the steel piling was anticipated as a result of bleeding the surrounding territory in pumping out the dam, the bridge was designed to support 60 ft., or six full lengths, of pipe. It consisted of two 60-ft. 12x12-in. longleaf yellow-pine timbers, spaced parallel 3 ft. center to center directly over the pipe line. These timbers rested on cribbing at each end, placed so that no direct pressure was transmitted to the section of the pipe line beneath. This cribbing was built up with a view to inserting jacks and wedges to take care of any future settlement. On top of each long timber another 40-ft. stick of the same size was scabbed symmetrically. An 8x8-in. timber 6 ft. long was then spiked horizontally across each end of the long timbers and holes bored in them on each side for 1½-in. truss rods. Four truss rods, one on each side of each timber, were tightened under two wooden bolsters placed at the third points, as shown in the illustration. The bolsters and threaded ends of these rods were fitted with plate washers.

After this structure was assembled, the excavation was carried down to the bottom of the pipe, permitting slings of ⅝-in. wire rope to be passed under the pipe at each point. These ropes, doubled and fitted with turnbuckles, were fastened to the ends of 8-in. round timbers placed on top of the supporting timbers over each joint.

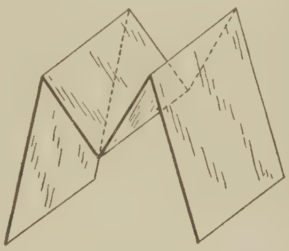
Level readings were then taken on each length of pipe and on the cribbing. The turnbuckles were then tightened until the pipe line barely started to rise, any settlement of the cribbing as the load was taken being overcome with wedges and jacks. In this way the temporary bridge was fully loaded and all deflection taken up before the soil under the pipe line was excavated, and without disturbing the grade of the line itself. Level readings were taken each day on both pipe line and supports, and settlement immediately corrected. Although the pipe line was supported for many months, no trouble was experienced, the load having since been transferred to the permanent structure. The writer was in charge of the work as superintendent for the contractor.

Bent Sheet-Metal Reinforcing Chairs Obtained Cheaply at Local Shop

By JOHN E. LANGLEY
Huntington, W. Va.

CHAIRS for supporting reinforcing steel were made by bending strips cut from old metal at a local shop and delivered to the job at a cost of $1.50 per 100 during the construction of the United States custom house and post office at Shreveport, La. The chairs were used later in constructing another building in the same city, and gave perfect satisfaction on both contracts.

These chairs proved strong and withstood rough handling. Forms and chutes were dropped on rods thus supported, and loaded barrows were wheeled over them without displacing or injuring any of them. Concrete flows readily around and between the legs of the chairs, and after the removal of the forms the thin metal strips of the legs did not show at all on the ceiling. The chair also possesses an advantage in holding reinforcing firmly against lateral movement. It is neither patented nor patentable.



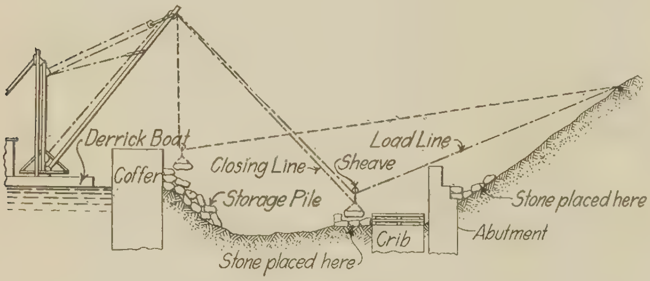
Trolley Principle Applied to Handle Three-Ton Stones with Derrick Boat

By G. W. McALPIN
New Richmond, Ohio

A DERRICK boat equipped with two lines for handling a grab bucket was recently converted into a cableway for handling heavy riprap stone to a considerable distance beyond the reach of the boom by using one of the lines for a track cable and the other to manipulate a single-block trolley. The same principle has been employed in other places, an instance of its use on the Sabine-Nachez Guard Lock having been cited in the Engineering Record of Nov. 27, 1915, page 674. The present case, however, differs from that mentioned in the direct use of the track cable for doing the hoisting and the attachment of the second cable to the block below the track cable. Also, as the derrick could readily be moved without unrigging the trolley, it was easy to cover a larger area from one anchorage.

The rig was used at Dam 35 to place a quantity of stone, which was not sufficient to justify setting up a derrick, in locations out of reach of derrick boats outside the cofferdam. The end of the load line from the three-drum hoist on the derrick was anchored to a deadman in the hill back of the abutment wall.

The trolley was made of a large sheave running this line with an iron strap on either side carrying chains and stone hooks. The closing line from the hoist on the boat was made fast to these straps and was used to check the load when it reached the required position. By carefully slackening both lines, the load line slightly more than the closing line, the load could be lowered accurately into place.



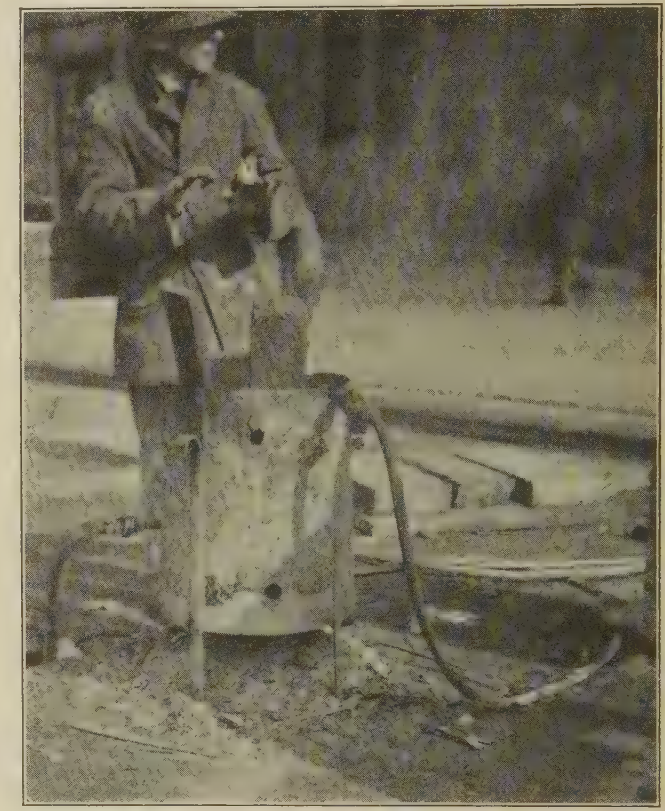
DERRICK BOAT QUICKLY RIGGED TO "TELEGRAPH" 3-TON STONES

In operation, the boom on the derrick boat was raised to nearly vertical position. Many of the stones placed in this manner weighed as much as 3 tons apiece, but were easily handled.

Coils Fitted in Old Salamanders Make Water Heaters for Subway Concrete

PORTABLE water heaters made by fitting coils of 1-in. pipe inside old salamanders are being employed by the Holbrook, Cabot & Rollins Corporation to heat the water used in remixing concrete for the subway structure on this company's section of the new Broadway line in New York City. As described in the Engineering Record of Dec. 23, 1916, page 760, the concrete for this section is mixed rather dry at a central plant located on the contractor's North River dock and hauled to the job in motor trucks. After being dumped on the street decking, more water is added, the concrete being remixed with hoes before being spouted to the forms below. During the cold weather it has been necessary to heat the water used in this remixing.

It is economical, of course, to deliver the concrete directly above where it is wanted, the hopper through which it is sent to the form being moved frequently as the work progressed. Therefore some form of water heater was required which would be more portable than the usual makeshifts resorted to, and which would be less of an obstruction to traffic. Several old salamanders, fitted with coils of pipe in the contractor's shop on the job, solved the problem. In use, the heater is connected to the nearest water line by a hose, coupled to the lower end of the coil inside the salamander. From the upper end of this coil at the top of the salamander a second hose 10 or 12 ft. long runs to the hopper. This hose is fitted with a plug cock next the salamander, so that when the line is not in use the water is shut off beyond the point where it is being heated.



WATER RUN THROUGH HEATING COIL IN OLD SALAMANDER

To avoid playing a heavy stream on the concrete and washing out part of the cement, a sprinkler nozzle is attached to the end of the short hose, being bushed to a short length of pipe. To this pipe is secured a ½-in. steel rod about 4 ft. long, which is stuck into the pile of concrete and supports the sprinkler at the desired point. With this arrangement the water "rains" down on the point where the concrete is being remixed with a hoe, and all washing is avoided.

The heaters have to be drained during very cold weather when not in use, as the wood fires in one or two of them went out recently on a cold night and the coils froze and burst.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Minnesota Proposes City-Manager Plan

Measure Before Senate Would Apply to All Towns of Less Than 10,000 Population

Adoption of the city-manager plan for the smaller cities of Minnesota is proposed in a bill before the Senate. The act applies to fourth-class cities, including all having less than 10,000 population, but is not to be put into effect until submitted to the people on petition of 20 per cent of the voters and adopted by a majority vote.

The bill provides that the town council would be left merely a legislative body, and provides for an elective civil-service commission, with general authority to employ help in the city departments, and for the naming of three members of a public utilities board, one of whom is to be chairman, one vice-chairman, and the third, to be chosen without regard to residence, to be city manager.

The city manager is to take the place of the city engineer, surveyor and street commissioner, and may act also as city recorder or clerk. He is to be responsible only to the other two members of the board, who may remove him at any time on written notice. His salary is to be fixed by the civil service commission.

Department of Agriculture Refutes Roads Reports

The Secretary of Agriculture gave out a statement Feb. 17 to refute the report that states desiring to obtain money for roads under the Federal Aid Road Act, which appropriates $85,000,000, must build only expensive roads, and to make it clear that no particular kind of material will be required or favored by the Department of Agriculture to the detriment of other materials.

"There is not the slightest truth in such a report," said Secretary Houston. "This department, which is charged with the administration of the Federal Aid Road Act, has placed absolutely no restrictions, either direct or implied, upon the kinds of highways to be constructed. States may submit for approval any kind of road, even an earth road, and approval will be given if the construction be substantial in character, suitable for traffic needs, and meets the terms of the federal act. To give state legislators and highway officials the impression that this department favors only costly types of road, or discriminates in favor of any particular material, results not only in spreading misinformation, but in placing barriers in the way of states which wish to avail themselves of federal aid in road construction."

Indiana State Highway Commission Shorn

The effectiveness of the proposed Indiana State Highway Commission was destroyed when the power of letting contracts for main market roads was taken from it and placed in the hands of the county commissioners in an amendment passing the Senate Feb. 12. The amendment also provides that the State highway engineer must submit specifications for two or more kinds of material for any proposed roads.

Back of the bill in its original form were the farmers' organizations, the livestock associations, the Indiana State grange, the traveling men's organizations, the Indiana Bankers' Association, the chambers of commerce throughout the State and many other civic and business organizations.

Metric System Adoption Gaining Headway

The Pan-American use of the metric system was agitated at the "metric conference" during the sixty-ninth meeting of the American Association for the Advancement of Science, held in New York during Christmas week, 1916. The outcome of the conference, which was attended by representatives of national business organizations, the U. S. Department of Commerce and men prominent in engineering and educational work, was the formation of a permanent organization to be known as the American Metric Association, the object of which was to further the adoption of the international meter, gram and liter, which have been legalized in the United States since 1886.

Officers of the Association

The officers of the association are as follows: President, George F. Kunz; vice-presidents, William Jay Schieffelin, E. R. Albrecht, and O. E. Stanley; treasurer, Arthur P. Williams; and secretary, Howard Richards, Jr., 156 Fifth Avenue, New York City, the address of the association. The executive committee consists of H. V. Army, Fred R. Drake, A. E. Kennelly, S. W. Stratton, and W. P. Wilson.

The association is especially desirous of receiving catalogs of manufacturers who use the metric system for domestic or export purposes.

NEXT WEEK

Prices of Construction Materials

Government Active in Industrial Preparedness

Signs at Washington Point to Preparations on a Scale of Unprecedented Magnitude

By the Engineering Record's Washington Representative

The United States of America, so far as industry is concerned, is rapidly being placed upon a war basis, reports from Washington show, as the result of the notification, Jan. 31, of the German government that unrestricted submarine warfare will be resumed notwithstanding the protests of the United States. A military war basis is also being brought about, to a certain extent.

Mobilization of Industrial Resources

The "mobilization of industrial resources," which has been so much talked of recently, is in fact now being given a practical test. Secretary Daniels of the Navy Department and Secretary Baker of the War Department have been in daily conference with members of the Naval Consulting Board and the National Defense Council. There have been filed with the Navy Department inventories of 1200 manufacturing plants which could produce war material, and a great many manufacturers of all classes of machinery, chemicals, etc., have placed their plants and their personnel at the disposal of the government for use if needed.

The outward signs of these activities in Washington are in great increases to the army and navy appropriation bills now in Congress, and another bill to place $150,000,000, by means of a bond issue, at the disposal of the President, available immediately. This sum is likely to be greatly increased, as official Washington recalls that at the outbreak of the Spanish-American War $50,000,000 was appropriated within 15 minutes, but it is realized that that sum, or triple that sum, would be but "a drop in the bucket" to-day, in view of the fact that $50,000,000 would not any more than buy two modern battleships, with arms and armament.

Outward Signs of Activity

Another outward sign of the mobilization to be seen in Washington is the fact that the State, War and Navy building has been closed to visitors. The government departments at Washington do not desire calls from contractors, builders, engineers, salesmen [illegible]ry etc. They cannot even obtain access [illegible]ey is the departments except upon w[illegible]ision of passes issued before Saturday [illegible] next two and every employee, from [illegible]t is a corker cers and the chief of staff of the army and the chief of staff of the navy down, is obliged to present such passes to the sentries on duty. Representatives of the industrial resources of the country who have material to offer the government must make their offers in writing and send them by mail.

The government is placing contracts in some cases without bids and in other cases is about to ask for bids for millions and millions of dollars' worth of equipment—all sorts of machinery and supplies which would place the country upon a war footing. Immediate purchase of reserve supplies, depleted because of the last Mexican crisis, has been ordered, and War Department purchasing agents were last week sent out into the open markets to obtain these supplies.

Appropriation Bills Before Congress

The army appropriation bill, the fortification bill (a separate measure), and the naval appropriation bill are well on their way through Congress. There have been added to the regular naval appropriation bill the sum of $15,000,000, one-third of which is for ammunition for merchant auxiliaries. There has been added to the regular army appropriation bill the sum of $8,000,000 for aviation, $11,000,000 for equipment and stores for the officers' reserve corps, and $5,500,000 for automatic machine guns for the army and national guard. A separate bill carrying $1,000,000 for the purchase of basic aeroplane and seaplane patents has been presented.

There is no question of the passage of these measures, nor is there any question that there will be written into the navy bill authorization for the Secretary of the Navy to take over for the government any private plant the government may need in a war emergency. The government has already practically taken over the private radio plant at Tuckerton, N. J., and within the past few days has replaced the civilian operators with United States Navy operators. Telephone, telegraph and wireless companies all over the country have offered their services and their plants to the government, and upon one occasion immediately following Germany's announcement, the afternoon of Feb. 1, a practical test of governmental use was put into effect on long-distance telephone wires out of Washington.

Navy Department Active

Orders have gone from Washington closing the navy yards of the country, and army and navy officers in Washington are acting as censors of news in the War and Navy Departments. The naval station at Newport has been instructed to enter upon the manufacture of torpedoes upon an extensive scale, and a board of officers has left Washington to examine proposed sites at Charleston, W. Va.; Cumberland, Md., [illegible] other points to determine their fit- for [illegible] the government armor-plate [illegible] located [illegible]viously authorized. It is ex- [illegible] there will be early action upon the government nitrate plant also previously authorized; and there is a harmony of feeling between Democrats and Republicans alike in Congress as to national defense measures, instanced in the fact that the Republicans have caucussed and have agreed to vote for an appropriation to build immediately 100 more submarines than are authorized in the pending naval bill if the Democrats should bring in such a measure.

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Salt River Irrigation Work Is Declared Completed

After several years of delay and much dispute over a proper assessment of costs, the Salt River irrigation project in Arizona has been declared completed. The office of the Salt River Valley Water Users' Association received formal notice to this effect Jan. 23, together with particulars of the method to be adopted for repayment of the moneys expended by the government in the building of the Roosevelt and Granite Reef dams, purchase and completion of the distribution system and installation of hydroelectric power plants.

The local association claimed that several millions have been wasted in useless and unutilized work, and has demanded subtraction of such sums. Only a relatively small subtraction has been made, however, and the project is assessed for the repayment at $60 an acre, or about $11,000,000 for the 183,000 acres that now have advantage of the water storage and distribution system. It is reported that this assessment rate will be contended by the users' association.

Repayment

Repayment of the assessed amount, under the amended terms of the Reclamation Act, will be spread over a twenty-year term, without interest. On Dec. 1 next the first installment will be due. It will be of 2 per cent, as will be the next three yearly payments. All following installments will be of 6 per cent. Within six months from date all land owners must signify their acceptance of the terms, the payments to constitute a first lien upon the lands. No one may be included for more than 160 acres, and the owners must live on or near the land. The first year's charge for maintenance and operation expense will be 75 cents an acre. The large sums received for electric power will be credited upon the principal amount.

Atlanta to Proceed with Terminal Improvements

A plaza terminal commission for the city of Atlanta, Ga., was created by ordinance Jan. 13 to carry into effect the proposed plaza scheme to improve terminal facilities for the city as proposed by Barclay Parsons & Klapp, consulting engineers, of New York City. V. H. Kreigshaber and P. H. Norcross, consulting engineers, of Atlanta, were appointed members of the commission.

St. Louis to Convert River Into Big Sewer

A plan to convert the River Des Peres into a big sewer at a cost of approximately $6,500,000 has been approved by the St. Louis Board of Public Service. The sewer, if built according to plans, will be 13 miles long and will cut more than 3 miles from the stream's length by straightening it out and "harnessing" it. The plan adopted will not be put into effect until the necessary funds are available, but formal approval by the board means that when the work is undertaken it must follow the plan placed in the board's record.

The plan calls for a single-barrel tube 32 ft. wide and 25 ft. high extending from the western city limits to the Union Avenue entrance to Forest Park. The section through Forest Park to Macklind Avenue would contain two tubes, each 29 ft. wide and 24 ft. high. The section from Macklind Avenue to the Mississippi would be an open concrete channel ranging from 90 ft. in width at the top to 200 ft. as it nears the river.

The River Des Peres, ordinarily a shallow stream, drains the hill country southwest and west of St. Louis, and in time of heavy rains becomes a torrent that floods streets and homes. If the sewer is built it is hoped the flood menace will be removed.

California Proposes County Highway Engineer

A bill now before the state legislature of California (Ream Assembly Bill No. 209) proposes to create the office of county highway engineer for each county in the state. This engineer would have all the authority for road work which is now vested jointly in the Board of Supervisors and the county surveyor. The engineer would buy or otherwise arrange for all necessary equipment for road building and would bear much the same relation to county-road work as does the state highway engineer to the road work of the state.

Employees' Welfare Cared For in Electric Company

To supervise education, employment and provision of opportunities for advancement of employees is the purpose of an industrial service department established by the General Electric Company at its Schenectady plant. The new welfare work will be under the management of E. B. Merriam, who has been connected with the company for 16 years, starting as a student in the testing department, and who now resigns from assistant engineer in the switchboard department to take up his new duties.

Engineer Office Abolished

The borough council of Carlisle, Pa., has abolished the office of borough engineer and will employ a consulting engineer when work is to be undertaken which would require such services.

Commission Engineers as Reserve Officers

As a result of legislation in the Army Reorganization Act passed last summer the War Department has examined and the chief of engineers of the Army has recommended for commissions about 340 officers in the Engineer Officers' Reserve Corps out of a total number of applications for examination amounting to about 1100. The prospect is that the United States will have in the near future many more officers, if needed, than are available from the supply of West Point graduates to serve in case of actual war with Germany. Examinations are taking place all the time, and the 340 engineer officers mentioned, as well as others to be passed upon, will be commissioned as majors, captains and first and second lieutenants.

One section of the corps for each branch and the staff of the Army is being formed, these including the arms of infantry, cavalry, field artillery, coast artillery, medical, adjutant general's, judge advocate general's, inspector general's, quartermaster's, ordnance, signal and engineer corps. Progress in the formation of the different corps similar to that among the engineers is being made in all these branches of the Army and the staff.

Idaho Engineers Are Opposed to Monopoly of Resources

Resolutions opposing legislation that would make water rights distinct property, independent of the land, were passed by the Idaho Society of Engineers at its closing session of the recent convention in Boise. The resolutions adopted stated that "soil and water are joint agents of production wherever irrigation is necessary, and the divided control of these agencies encourages speculation, tends toward monopoly of our natural resources, and stands in the way of obtaining the highest duty of water in irrigation."

Propose Water-Power Commission for New York

The establishment of the Water Power Development Commission of New York State to consist of the state engineer and surveyor, conservation commissioner, attorney-general and superintendent of public works, to investigate the character, value and extent of location of surplus waters of the state available for power or other electrical development and report to the Legislature Feb. 1, 1918, is provided for in a bill introduced at Albany Feb. 9. The members of the commission are to serve without additional compensation. The sum of $40,000 is appropriated for expenses.

The introduction of this measure is thought to mark the revival of the hydroelectric activity which was actively supported by Governor Glynn in 1913.

Spring Flood Feared on Rivers in Pennsylvania

Fearing that floods may occur this spring from ice gorges in the two streams, Pennsylvania's Water Supply Commission, with main offices in Harrisburg, is keeping a watchful eye on the Susquehanna River and Alleghany River watersheds. Oil City reports an ice jam 60 miles long in the Alleghany River and the ice is gorged for more than 75 miles in the Susquehanna, beginning 15 miles north of Harrisburg and continuing toward the bay.

Ten years ago several hundred thousand dollars damage was done at Middletown, Pa., when the ice gorged and backed up the flood waters. It is said that the ice is 2 ft. thick in places, and cakes are jammed one upon another to a height of 15 to 20 ft. February and March are the months of heavy snows in the Susquehanna watershed, and when the spring thaws come, trouble is more than likely, says the commission.

Begin Work on Irrigation Canal in Washington

A corps of engineers will be put in the field at once on the proposed irrigation canal to water 120,000 acres in the Wenas, Selah and Moxee valleys and a considerable amount of land above the present Lewinpide Canal below Union gap, according to R. K. Tiffany, manager U. S. Reclamation Service at North Yakima, Wash. Estimates for the work will be submitted to the Secretary of the Interior at Washington, D. C. Water will be taken from Naches River, also storage water from the present work, as more water is now stored than is needed at the McAllister Meadows reservoir.

Decision Affects Repaving of Pennsylvania Streets

The State Supreme Court of Pennsylvania, in refusing on Jan. 31 to hear the appeal of the city of Pottsville from the adverse decisions of the Schuylkill County and superior courts in its action to compel abutting property owners on Market Street to defray assessments covering the cost of installation of wood block pavement on the thoroughfare, has made binding the law, applying to all third-class cities in the state, that streets which are macadamized cannot be paved at the expense of abutting property owners. This decision also practically annuls that provision of the Clark act operative in the state creating a commission form of government and giving city councils the express authority to improve macadam streets and assess property owners for the cost of the new paving.

Prior to the rendering of this decision, forty-five property owners defrayed their share of the expense, and it is said that the legislature will be asked to refund this money.

Water-Power Bill in Congress Receives Little Consideration

As the result of opposition in the Senate, principally on the part of Senator Fall of New Mexico, there has been but little consideration in that body of the bill to provide for the development of water power and the use of public lands in relation thereto. One of the most serious stumbling blocks in the way of the bill has been presented by Senator Fall, who has announced that he will vote against the measure, "with or without discussion," an attitude that will have its effect on other senators because of the state Senator Fall comes from and the presumable interest of that state in the measure. Senator Townsend of Michigan has also objected to the consideration of the bill.

North Dakota Engineers Propose Licensing Law

A licensing law for land surveyors was again submitted to the legislature by the North Dakota Society of Engineers at its annual meeting Jan. 30 and 31 in Bismarck. The law provides for the examination (and licensing upon due proof of qualifications) of land surveyors in the state, and requires that none except licensed surveyors shall be allowed to hold the office of county surveyor, or issue surveyors' certificates or certify plans or plats for filing in any case where the location of property lines is thereby involved.

Officers elected for the coming year are: President, J. A. Ingram; vice-presidents, R. H. Slocum and J. H. Clark; secretary-treasurer, E. F. Chandler, University, N. D.

The next annual meeting will be held at Fargo.

Swiss Asks American Engineer's Advice on Bog Drainage

A much-censored letter was recently received by H. B. Walker, associate professor of irrigation and drainage engineering, Kansas State Agricultural College, from L. C. Bryan of Villa Miguel, Switzerland, relative to the possibilities of draining a large Swiss swamp. The letter in part follows:

"I am interested in reclaiming a tract of bog land that is covered with water three months of the year in ordinary times. It has been raining almost incessantly since the war began three years ago. In ordinary times there is little or no water here, however, for nine months in the year.

"Will you advise me as to the best methods to follow? We could erect windmills to do the pumping or we could use electricity, for it is very cheap here. The land is entirely surrounded by the embankments of the country highways. All of the Rhone Valley is to be drained under the supervision of the State engineers within the next two or three years, but this bit is a corker to them."

Engineering Society Activities

Engineers' Society of Northeastern Pennsylvania has elected the following officers for the ensuing year: President, Frank J. Duffy; vice-presidents, J. M. Humphrey and J. M. Gaynor.

Indiana Engineering Society has elected the following officers: President, C. F. Harding; vice-president, W. H. Insley; secretary, Chas. Brossmann, Indianapolis, Ind.

Binghamton Engineering Society has elected officers as follows: President, Robert B. Hoadley, Jr.; vice-presidents, Frederick E. Beck, Clarence A. Dayton and Carl E. Anderson; treasurer, D. M. Edgerton; secretary, W. Earl Weller.

Kansas Engineering Society has elected the following officers to serve for the present year: President, H. B. Walker; vice-president, Con. M. Buck; secretary-treasurer, C. A. Haskins, Lawrence, Kan.

Engineers' Club of Seattle announces the following officers: President, E. B. Hussey; vice-president, R. H. Ober; secretary, J. Thomas Dovey.

What Engineers and Contractors Are Doing

E. K. SHEBLE, contractor and engineer, until recently with the Washington Construction Company, Seattle, has become associated with the Stone & Webster Engineering Corporation, with headquarters at Boston. Mr. Sheble was for three years connected with the engineering department of the city of Seattle, after which he joined the Washington Construction Company.

FRED BENNETT has resigned as highway engineer of Bexar County, Texas, to become a member of the firm of Julian C. Feild & Company, consulting engineers, Denison, Tex. Mr. Bennett was associated with Julian C. Feild during 1910-11 in the building of the Denison road system. During his four years as highway engineer he built the Bexar County highway system at a cost of slightly over $1,500,000, and since the completion of the road system has inaugurated a maintenance system for county roads.

F. H. FRANKLAND has become associated with the firm of Waddell & Son, consulting bridge engineers, of Kansas City, in charge of their recently opened branch office at 165 Broadway, New York City. Prior to his present position Mr. Frankland was engineer of bridges, Calcasieu Parish Highway Department, Lake Charles, La. He has had several years of general practice in cival engineering and four years of specialization in bridge designing and construction in New Zealand and Australia. He was educated in New York and took a course in chemical engineering under his grandfather, Sir Edward Frankland, K.C.B., London.

T. H. GATLIN, assistant chief engineer maintenance of way and structures, has been made assistant to the vice-president of the Southern Railway lines.

B. HERMAN, until recently chief engineer maintenance of way and structures of the Southern Railway, with headquarters at Washington, D. C., has been appointed chief engineer maintenance of way and structures, Southern Railway, Lines East, with headquarters at Charlotte, N. C.

C. M. THOMPSON has been appointed division engineer, Colorado division of the Union Pacific, with headquarters at Denver, Col., vice George F. Davis.

C. M. RATCLIFF, assistant engineer of maintenance of the Southern Railway, at Washington, D. C., has been appointed office engineer of the Southern Railway System, with headquarters at Washington, D. C.

HUGH B. HOLMES, resident engineer of the Kansas City, Mexico & Orient Railway, has been appointed chief engineer, with headquarters at Kansas City, Mo.

J. D. CLAIR SMITH is successor to Tolman Engineering Co., Houston, Tex. He will continue the company's line of work, which is a general civil, mechanical and marine engineering practice. Mr. Smith, formerly of Hartington, Neb., was previously engaged in a general consulting-engineering practice.

J. T. COLLINS, formerly chief engineer, Department of Public Works, Santo Domingo, has been appointed general manager of the Dominican Government railroads by the head of the Military Department, Captain H. S. Knapp, U. S. Navy. Mr. Collins will have charge of construction, maintenance and operation of all railroads operated by the government of Santo Domingo.

E. WELDEN has resigned from the Thor Construction Company, of Cedar Falls, Iowa, and will engage in bridge contracting with the Welden Construction Company, Iowa Falls, Iowa.

ALFRED A. ANDERSON has resigned as assistant engineer with the Imperial Irrigation District, Calexico, Cal., to go with the California Railroad Commission at San Francisco.

CHARLES E. VAN VALKENBERG has been appointed city engineer of Fresno, Cal., to succeed B. E. Cronkite. Mr. Van Valkenberg was first deputy city engineer at the time of his appointment.

J. D. DAVIS, recently appointed representative of the Producers' Oil Company, has gone to Central America, Venezuela and Colombia to help develop the oil production of those countries. Mr. Davis was formerly on the Island of Trinidad, in charge of development of the oil industry.

S. A. JUBB, who has for several years been in charge of harbor construction work at Los Angeles, Cal., completes his work in that capacity on March 1.

B. E. CRONKITE has been transferred from the position of city engineer of Fresno, Cal., to the position of engineer in charge of sewer construction. He will have supervision of construction work on the $500,000 storm and sanitary sewer systems, contracts for which were let by the city several months ago.

A. B. COLLINS has been appointed district engineer for Yakima county (Wash.) highways. Mr. Collins was graduated from the Colorado State Agricultural College in 1908 and was for two and one-half years in the Philippines with the Bureau of Lands as surveyor in charge of the Friar land computations. He was later engaged in the office of the City Engineer, North Yakima, Wash., and for two and one-half years was with Yakima county, Wash., on drainage work.

W. S. BARSTOW & COMPANY, INC., of New York, engineers and constructors, have opened an office in Sandusky, Ohio, in charge of C. B. Wilcox, who will also continue to represent the Barstow interests in Sandusky as chairman of the board of the Sandusky Gas & Electric Company. The Sandusky office will conduct a general engineering and constructing business along the lines pursued by W. S. Barstow & Company from their New York and Portland (Ore.) offices.

AMOS A. FRIES, major, Corps of Engineers, in charge of and stationed at Yellowstone Park, has been placed in charge of the river and harbor improvements in the First Portland (Ore.) District. This work, which is in addition to the work at the park, embraces all improvements on the upper Columbia and Snake rivers and all Oregon harbors on the Pacific Coast south of the Columbia River.

H. RAY KINGSLEY, engineer in charge of building engineering design for the Philippine government, is in Chicago, 1417 Railway Exchange, while enjoying an eleven-month vacation.

GEORGE F. BROWN has resigned as resident engineer for Black & Veatch, consulting engineers, Kansas City, Mo., to become assistant engineer with the Coventry Land & Improvement Company of Akron, Ohio. Mr. Brown has been with Black & Veatch since his graduation from the University of Michigan in 1913.

R. N. KELLOGG has been appointed city engineer of Coquille, Ore.

ERIC T. KING has been appointed assistant secretary of the General Contractors' Association, New York City. Mr. King, who is a graduate of Union

College, class of 1905, was for ten years assistant engineer on the Catskill water system for New York City, and latterly has been assistant to Lederle & Provost, consulting sanitary engineers, New York City.

Jacob L. Crane, Jr., who has been in the employ of Burns & McDonnel, consulting hydraulic and sanitary engineers, Kansas City, Mo., since his graduation from the University of Michigan in 1913, has just resigned his position in order to go with the Michigan State Board of Health as assistant engineer. He is at present engaged on a sanitary survey at Saginaw, Mich.

George L. Kelly is with the Heller Brothers Company, at Youngstown, Ohio, instead of Houston, Tex., as stated in the Feb. 3 issue.

Charles R. Henderson is circulating among the members of the American Water Works Association a post card bearing the following message: Dear Sir—My name has been placed on the ballot as candidate for President of the American Water Works Association without my knowledge or consent. Mr. Theodore A. Leisen of Detroit is the regular nominee, and I ask you to do all you can to secure his election. Sincerely, Charles R. Henderson. Davenport, Ia., Feb. 14, 1917.

T. N. Gilmore, chief engineer, Westinghouse Church Kerr & Company, has been elected second vice-president and chief engineer. He has been connected with the company for thirteen years.

R. C. Kellogg has become associated with E. W. Bemis, consulting engineer, Chicago, on valuation of distribution system, Peoples Gas Light & Coke Company, Chicago. Mr. Kellogg has had ten years' experience in the distribution of gas. He was with the Consolidated Gas Company of New York for four years as designing draftsman and field engineer. Later he was for six years connected with the Brooklyn Union Gas Company, Brooklyn, as engineer and assistant to superintendent.

W. M. Carpenter, until recently junior engineer on the staff of the Chicago Traction and Subway Commission, has been appointed engineer for the Charleston Interurban Railroad Company, with headquarters at Charleston, W. Va.

Allen & Garcia Company, consulting and constructing engineers, Chicago, announce the establishment of a power department, which will be in charge of C. M. Garland, an expert in the different phases of steam and gas-power engineering. The electrical work in connection with this department will be handled, as at present, by W. C. Adams.

John R. Downes, formerly chemist and manager of the sewer department, Plainfield, N. J., is now superintendent of the joint sewage-disposal works of Plainfield, North Plainfield and Dunellen. Mr. Downes was educated at Rensselaer Polytechnic Institute. He then spent two years as chemist for the water-purification plant at Harrisburg, Pa., after which he went to Panama, where for 5 years he was physiologist in charge of sanitation of water supplies. He then returned to Plainfield.

Olin Arnspiger has been appointed engineer and water superintendent of Medford, Ore.

R. S. Charles, engineer maintenance of way of the Detroit division of the Wabash Railroad, has been appointed to a similar post on the Peru devision, headquarters at Peru, Ind. He is succeeded by W. K. Walker.

J. W. Burt, engineer maintenance of way of the Cleveland, Cincinnati, Chicago & St. Louis Railway, at Wabash, Ind., has been appointed engineer maintenance of way of the Chicago division at Indianapolis, vice R. Ferriday, resigned. C. W. Engle has been appointed engineer of maintenance of way of the Michigan division, vice Mr. Burt.

Louis Yager has been appointed acting engineer maintenance of way of the Northern Pacific Railway, lines east of Paradise, Mont., with headquarters at St. Paul, Minn.

J. Powell Wehrung has resigned his position as assistant city engineer, Amarillo, Tex., and has accepted the office of resident engineer, Childress, Tex., with Henry E. Elrod, Dallas.

Edwin S. Fuller, of Los Angeles, formerly assistant engineer in the U. S. Geological Survey, has been retained by the Department of the Interior to prepare a special water-supply paper dealing with the determination of the stage-discharge relation for open channels. Mr. Fuller has made a special study of stream-flow problems during the last eight years, and has been engaged during the past season on intensive hydrometric work for the Twin Falls North Side Land & Water Company, at Jerome, Idaho.

Martin Schacht, contractor-architect, has opened offices in Portland, Ore. Mr. Schacht has been identified with both the designing and erection of many structures in and around Portland.

Charles Boone has been appointed county engineer of Hancock County, Indiana. Mr. Boone was graduated from Purdue University in 1912 and has since been engaged in the contracting business in Iowa.

Bert W. Macy, whose name appeared in this section in the issue of Jan. 20 as city engineer of Salem, Ore., is attorney for that city. Walter Skelton is city engineer.

Earl B. Smith, formerly associate mechanical engineer with the U. S. Office of Public Roads and Rural Engineering, Washington, D. C., in charge of physical research and concrete investigations, has been transferred to the U. S. Bureau of Soils as mechanical engineer. Mr. Smith is a graduate of the University of Missouri, class of 1903. Since graduation he has been employed with the Wabash Railroad, Struthers-Wells Company, Philadelphia Rapid Transit Company and the Drexel Institute, Philadelphia, at which latter place he was assistant professor of experimental engineering for more than nine years. He has also carried on considerable private practice in commercial and industrial investigations. Mr. Smith's new duties will be along engineering lines in the design and construction of the new Government potash plant to be located at Summerland, Cal., where he, with Dr. Turrentine, scientist of the Department of Agriculture, will investigate the commercial possibilities of extracting potash, iodine, tar products, acetone, etc., from the kelps of the Pacific Coast.

Joseph H. Ehlers has left the service of the Delaware, Lackawanna & Western Railroad at Buffalo and entered the employ of the Bethlehem Steel Bridge Corporation at Steelton, Pa.

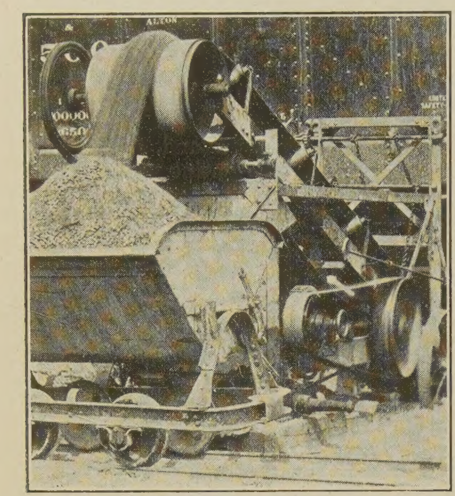
Obituary Notes

Howard A. Greene, manager of erection, Pittsburgh division, American Bridge Company, Pittsburgh, Pa., died Feb. 2. Mr. Greene was born at Providence, R. I., Sept. 15, 1860. After his graduation from Brown University he was engaged in construction work in different sections of the country. This work included the location and construction of railroads, making of extensive surveys and the construction of terminal piers. From 1892 to 1901 he was assistant engineer for the New York district of the New Jersey Steel & Iron Company, where his last position was that of erection engineer. In July, 1901, he was appointed erection manager of the Pittsburgh division of the American Bridge Company, which position he held until the time of his death. While serving in this capacity he was in charge of the erection of many important structures, and was also the inventor of a number of important patented erection devices.

George Henry Hill, assistant engineer of the railway and traction department of the General Electric Company, died Jan. 31 at his home in Schenectady, after a short illness. Mr. Hill was graduated from Johns Hopkins University in 1895, and early in his career as an engineer invented and patented the electric system for operating bulkhead doors on shipboard. Later he assisted in the development of the multiple unit system of train control. In connection with this work he produced the multiple-unit automatic system substantially as it exists to-day. During the past few years Mr. Hill had devoted considerable time to the electrification of steam railroads.

Gas-Engine Driven Unloader Is Portable

A portable unloader of the belt-conveyor type, originated for handling road materials by Allen Parrish, contractor, Paris, Ill., is shown herewith. It consists of a four-wheeled truck carrying a 6-hp. Novo engine driving an inclined belt, the lower end of which may be extended under the car hopper. The extension is hinged so that it may be folded up, while the steep incline is hinged at the top so that the angle may be changed by raising or lowering the supporting chains. A car puller is part of the outfit, which can be set up, it is asserted, in two hours.

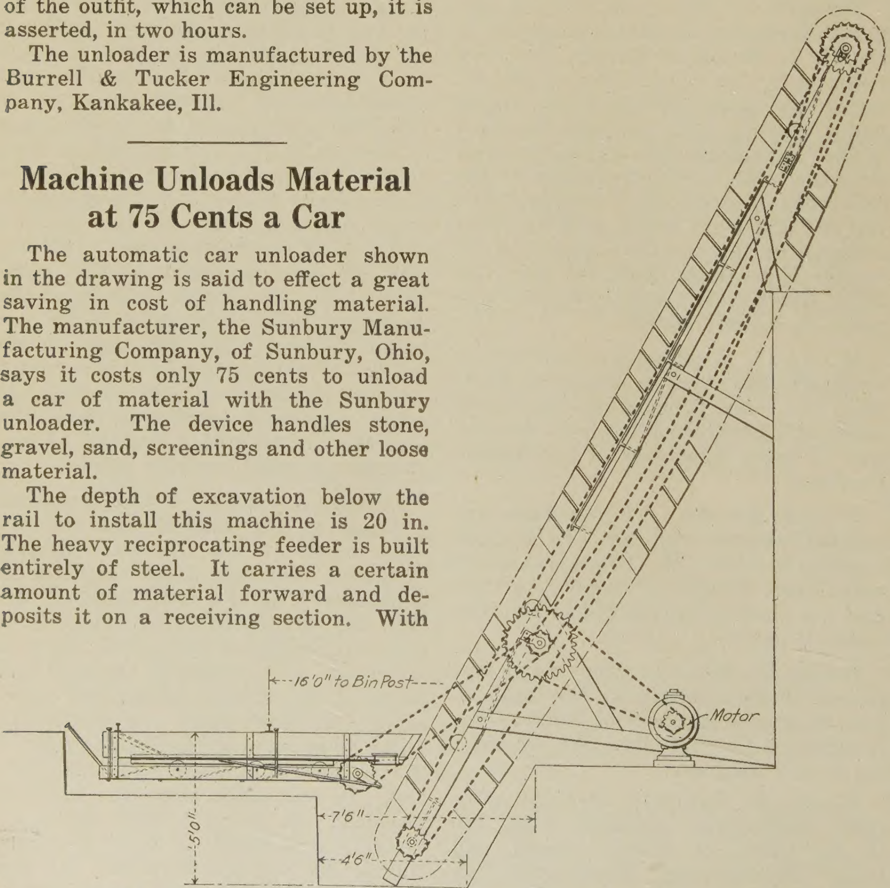

MACHINE WILL UNLOAD CAR IN 25 TO 40 MINUTES

The unloader is manufactured by the Burrell & Tucker Engineering Company, Kankakee, Ill.

Machine Unloads Material at 75 Cents a Car

The automatic car unloader shown in the drawing is said to effect a great saving in cost of handling material. The manufacturer, the Sunbury Manufacturing Company, of Sunbury, Ohio, says it costs only 75 cents to unload a car of material with the Sunbury unloader. The device handles stone, gravel, sand, screenings and other loose material.

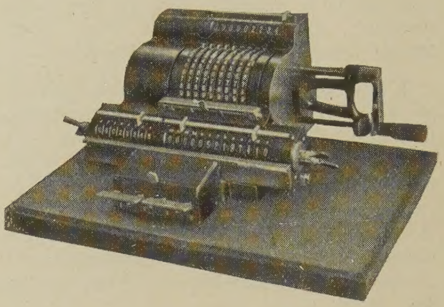
The depth of excavation below the rail to install this machine is 20 in. The heavy reciprocating feeder is built entirely of steel. It carries a certain amount of material forward and deposits it on a receiving section. With the next stroke the material previously deposited is moved into the bucket elevator. The manufacturer declares that one man can operate the machine. No belt conveyor, hoisting skip or bucket is employed. A factor of safety of 2 has been used in the design.



NEW UNLOADER SAID TO REDUCE COST OF HANDLING MATERIAL

Lightweight Calculating Machine Put on Market

A new lightweight calculating machine has just been put on the market by the Marchant Calculating Machine Company, Emeryville, Oakland, Cal. The so-called "Marchant Pony" is made in two sizes, one weighing 12 and the other 13 lb. One has thirteen digit places on the product or quotient dial, the other eighteen places. The smaller model sells for $275, the larger $325.


NEW CALCULATING MACHINE IS LIGHT AND COMPACT

Business Notes

Central Creosoting Company of Chicago has purchased the plants and good will of the Chicago Creosoting Company.

Goulds Manufacturing Company of Seneca Falls, N. Y., manufacturer of pumps, has just made announcement of a bonus of an extra month's salary given to all employees. This includes all office employees both at the home office and branches, and all shop employees on the weekly and monthly basis. In November the company granted a wage increase of 10 per cent on all piece work.

Pacific Tank & Pipe Company has completed the first of the buildings of its new plant located on a 95-acre tract near the Melrose station of the Southern Pacific Railroad on San Francisco Bay. The plant is made up of four main buildings from 200 to 260 ft. long and 100 ft. wide.

Northwestern Steel & Iron Works, Eau Claire, Wis., has received another order for four mixers from the government of the United States, Panama Canal Division. Four No. 610 Northwestern mixers of 10 cu. ft. capacity were bought last May for work on the canal at Colon. The new machines, of the same size and capacity as the others, are to be used on the other end of the Canal Zone.

Trade Publications

The following companies have recently issued trade literature:

Foote Concrete Machinery Company, Chicago. Illustrated folder on Foote street-railway paving mixer.

Sauerman Brothers, Chicago. Catalog, 56 pages, describing power scrapers.

Wallace Supplies Manufacturing Company, Chicago. Catalog describing hand power bending tools.

Chicago Pneumatic Tool Company, Chicago. Folders on Duntley portable tools, hose, couplings and hose clamp tools.

G. H. Williams Company, Erie, Pa. Illustrated catalog, 48 pages, devoted to digging buckets.

Spray Engineering Company, Boston. Bulletin 250, describing Spraco equipment for washing and cooling air.

Gramm Bernstein Motor Truck Company, Lima, Ohio. Illustrated catalog, 30 pages, devoted to Gramm motor trucks.

Novo Engine Company, Lansing, Mich. Catalog 16, 80 pages, illustrated. Lists and shows Novo engines and outfits.

Niles - Bement - Pond Company, New York City. Condensed catalog, 48 pages, illustrated, listing machine tools.

American Sheet & Tin Plate Company, Pittsburgh. Catalog 120, relative to black and special sheets; 26 pages, illustrated.